Possible reproduction of the red-eared slider, *Trachemys scripta elegans* (Reptilia: Testudines: Emydidae), in Serbia, under natural conditions

Moguća reprodukcija crvenouhe kornjače, *Trachemys scripta elegans* (Reptilia: Testudines: Emydidae), u Srbiji, u prirodnim uvjetima

SONJA ĐORĐEVIĆ[1,3], MARKO ANĐELKOVIĆ[2]

[1]*University of Belgrade, Faculty of Biology, Institute of Zoology, Studentski trg 16, 11000 Belgrade, Serbia, sonjadj@bio.bg.ac.rs*
[2]*University of Belgrade, Institute for Biological Research "Siniša Stanković", Despota Stefana Blvd. 142, 11000 Belgrade, Serbia*
[3]*Serbian Herpetological Society "Milutin Radovanović", Despota Stefana Blvd. 142, 11000 Belgrade, Serbia*

Abstract

The North American chelonian, *Trachemys scripta elegans*, is still among the most popular pets worldwide. However, if released into natural water bodies outside of its natural distribution range it becomes a great nuisance and threat to native freshwater turtles and other aquatic wildlife. We report, for the first time, on the case of possible reproduction of the red-eared sliders under natural conditions in north-central Serbia. In July 2014 we found two red-eared slider hatchlings near the canal in the settlement of Borča near the Serbian capital. Judging by their body sizes and appearance (muddy shells, curved carapace), they had recently hatched near the place where they were found.

Key words: Serbia, red-eared slider, reproduction

Sažetak

Sjeverno-američka vrsta kornjače, *Trachemys scripta elegans*, danas je jedna od najpopularnijih kućnih ljubimaca širom Svijeta. Ipak, ako joj se omogući bijeg u prirodna staništa, postaje vrlo velik problem i prijetnja domaćoj barskoj kornjači i generalno vodenim životinjama. U ovom radu, po prvi put, izvještavamo o slučaju potencijalne reprodukcije crvenouhe kornjače u prirodnim uvijetima na području sjeverne i centralne Srbije. U srpnju 2014. Pronašli smo dva tek izlegla mladunca crvenouhe kornjače u blizini odvodnog kanala u selu Borča (okolica Beograda). Sudeći prema njihovoj duljini tijela i generalnim karakteristikama (blatni oklop, zabljeni karapaks), može se ustvrditi da su se tek izlegli vrlo blizo mjesta pronalaska.

Ključne riječi: Srbija, crvenouha kornjača, reprodukcija

Trachemys scripta (Schoepff, 1792) is an aquatic turtle native to the New World (van Dijk et al. 2013); one of its three subspecies (Bringsøe 2006), *Trachemys scripta elegans* (Wied-Neuwied, 1839), is listed among the 100 worst invasive alien species in the world (Scalera 2006; van Dijk et al. 2013). *Trachemys* species are popular pets, but they are also used for human consumption or for religious purposes (e.g. Ramsay et al. 2007, Mali et al. 2014). For decades (between 1950's and 1970's), app. 10 million individuals had been imported annually into the Old World countries;

during the 1980's this rate lowered, but still, e.g. in 1996, over 2 million individuals were imported into Europe (Bringsøe 2006; Scalera 2006; Ramsay et al. 2007). Between 1989 and 1997 a total of 52 million individuals were exported from the USA farms (Cadi et al. 2004; Scalera 2006). Despite legal restrictions, export rates of wild-caught and commercially bred freshwater turtles from the USA are still high (Mali et al. 2014). When these turtles outgrow their aquaterraria, many owners decide to "release" their red-eared pets into natural or artificial water bodies; being highly resistant and adaptable, they manage to survive and often to reproduce as well (Rödder et al 2009).

Introduced populations of *T. scripta* already exist in numerous countries, on all continents except Antarctica (Cadi et al. 2004, Ramsay et al. 2007, Pérez-Santigosa et al. 2008). The red-eared slider is often widely distributed in its new territory (Cadi & Joly 2004; van Dijk et al. 2013). In Europe, breeding populations of *T. scripta* have also been documented, mostly in regions with a Mediterranean climate, where both sexes can be produced under natural incubation conditions (Cadi et al. 2004, Perez-Santigosa et al. 2008, van Dijk et al. 2013). However, reproduction of *T. scripta* has already been recorded in several localities with a more continental climate, e.g. in Austria, Switzerland, Slovenia and, potentially, the Czech Republic (Brejcha et al. 2009, Vamberger et al. 2012, van Dijk et al. 2013, Kleewein 2014).

The usual way of introducing these animals outside of their natural range is a deliberate release by their owners/breeders; therefore, they are most abundant in urban and semi-urban habitats (Arvy & Servan 1996, 1998, Cadi et al. 2004, Bringsøe 2006, Semenov 2010, Dimancea 2013).

The IUCN authorities decided that "European populations are either tolerated or their elimination is desired" (van Dijk et al. 2013). Import of *T. s. elegans* into the EU has been banned since 1997 (Bringsøe 2006); however, other subspecies are being imported instead (van Dijk et al. 2013). Individual EU members also forbid the trade in this species, but in some it can still be easily bought, along with other allochthonous chelonians (e.g. Kitowski & Pachol 2009, Semenov 2010). In Serbia, *T. scripta* is listed as invasive (Lazarević et al. 2012), and the import of all its subspecies is forbidden (Official Gazette of the Republic of Serbia No. 99/2009-26, 6/2014-9). Nevertheless, it is still available for sale (Urošević et al. in press).

On July 7th 2014, in the Belgrade suburban settlement of Borča, along the Sebeš canal (44°52′14.60″N, 20°28′44.04″E, 69 m a.s.l), one of the authors (M. A.) found two hatchlings of *Trachemys scripta elegans*. Borča lies on the left bank of the Danube River. It belongs to the biogeographic region of Banat, which is a part of the flat and moist lowlands of the Pannonian plain (Marković 1970, Stevanović 1992). In this area there is a natural wetland, and a huge pond further from the river, but small artificial water bodies also exist; several canals run through the settlement. In these canals, M. A. observed *Emys orbicularis* (L., 1758) on several occasions.

One of the collected red-eared slider hatchlings was dead (probably run over by a vehicle), but another was alive and healthy (Figure 1). The latter had straight carapace length of 28.3 mm, and its body weight was 4.6 g. This individual was euthanized and will be kept in the herpetological collection of the Faculty of Biology, University of Belgrade.

Tucker (2000) reported *T. s. elegans* hatchlings' average carapace lengths of 31.6 mm (the range he recorded was 27.0 mm – 35.4 mm); their average body mass was 6.92 g (3.94 g – 8.77 g). Considering the size of the sliders we found, we

presume that they could not have been released by a negligent pet-owner, but probably hatched naturally, in the vicinity of one of the canals in Borča. Additional feature to support this possibility is strongly curved carapace of the live hatchling: Perez-Santigosa et al. (2008) noted that shells of newly hatched sliders are highly domed.

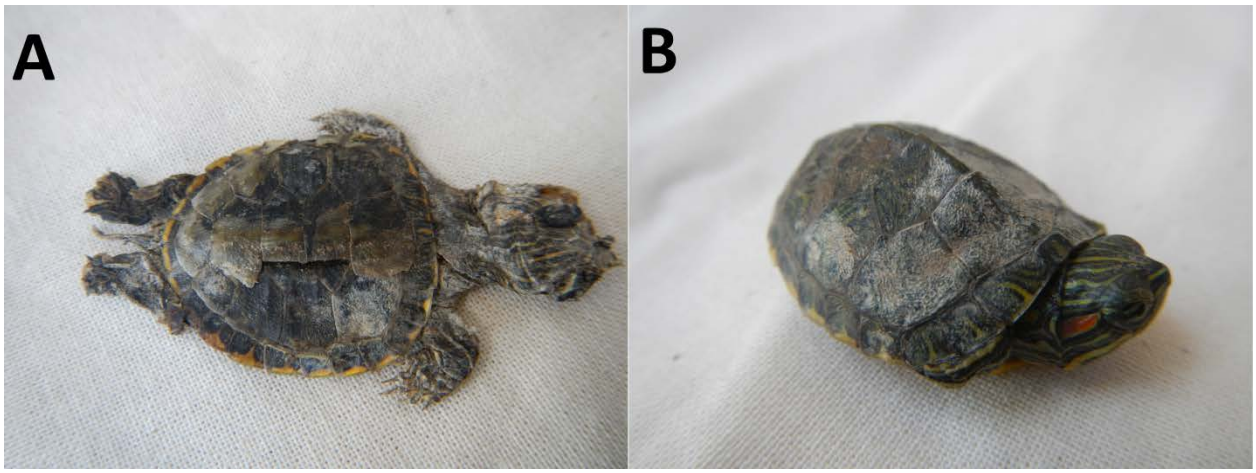

Figure 1. *Trachemys scripta elegans* hatchlings found from Borča: A) the one found dead on the road; B) alive individual

Slika 1. Netom izvaljeni mladunci vrste *Trachemys scripta elegans* iz Borča: A) jedinka pronađena mrtva na cesti; B) živa jedinka

Previously, adult *T. scripta* specimens/populations were reported from numerous places in Serbia (Džukić et al. 2008, Lazarević et al. 2012, Urošević et al. in press). To our knowledge, its reproduction in Serbia has not previously been confirmed and publicised. It is possible that the red-eared sliders breed in the public park in Novi Sad: a population of approximately 150 individuals inhabits the park pond (Urošević et al. in press), and people reported seeing small turtles there. More importantly, we obtained reliable information from the veterinarian in the Belgrade Zoo: *T. elegans* hatchlings were found in the Zoo in 2013 and 2014 (the Zoo had been accepting adult sliders, but no juveniles). In Serbia, moderate continental climate predominates. The 2013/2014 winter was mild, and entire 2013 was extremely warm – seventh warmest in the past 60 years (Republic Hydrometeorological Service of Serbia). Such climatic conditions apparently were sufficient to enable *T. scripta* survival and reproduction under natural conditions. Biology of *T. scripta elegans*, its high potential for invasions and interactions with native species have already been addressed by numerous researchers (Packard et al. 1997, Gist & Congdon 1998, Cadi & Joly 2003, 2004, Cadi et al. 2004, Bringsøe 2006, Scalera 2006, Ultsch 2006, Perez-Santigosa et al. 2008, Polo-Cavia et al. 2008, 2011, 2012, Semenov 2010, van Dijk et al. 2013) and are out of the scope of the present paper, hence we will not discuss them here.

On May 23rd 2015, at 12:45, photographs were made (Figure 2) of a large *T. s. elegans* female (carapace length about 25 cm) laying eggs in Novi Sad, on the sandy shore of a branch of Danube between Kameničko ostrvo and the city (Sime Matavulja Street, app. 45.231997N, 19.821397E).

Figure 2. A large red-eared slider laying eggs in Novi Sad (photo: Dejan Kolar)

Slika 2. Velika crvenouha kornjača polaže jaja u Novom Sadu (fotografija: Dejan Kolar)

The possible presence of breeding populations of a species with potentially significant negative impacts on autochthonous fauna implies an emergent need to intensify the research concerning the ecology of native and invasive aquatic chelonians, and to strictly implement the existing legislation. A sound prevention of introduction and spreading of invasive species is imperative. All subsequent investigation efforts, control and eradication measures are time- and energy-consuming and extremely expensive (Scalera 2007, Valdeón et al. 2010), and their results and outcomes are uncertain.

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References

Arvy, C. & Servan, J. (1996): Distribution of *Trachemys scripta elegans* in France: a potential competitor for *Emys orbicularis*. In Fritz, U., Joger, U., Podloucky, R., Servan, J. & Buskirk, J.R. (eds.) Proceedings of the EMYS Symposium, Dresden, Germany.

Arvy, C. & Servan, J. (1998): Imminent competition between *Trachemys scripta* and

Emys orbicularis in France. In Fritz, U. et al. (eds.) Proceedings of the EMYS Symposium Dresden 96. Mertensiella 10: 33–40.

Brejcha, J., Miller, V., Jeřábková, L. & Šandera, M. (2009): Výskyt *Trachemys scripta* na území ČR [Distribution of pond slider (*Trachemys scripta*) in the Czech Republic]. Herpetologické Informace 8: 14–29.

Bringsøe, H. (2006): NOBANIS – Invasive Alien Species Fact Sheet – *Trachemysscripta*. In Online Database of the North European and Baltic Network on Invasive Alien Species – NOBANIS, www.nobanis.org. Accessed on July 14, 2014.

Cadi, A. & Joly, P. (2003): Competition for basking places between the endangered European pond turtle (*Emys orbicularis galloitalica*) and the introduced red-eared slider (*Trachemys scripta elegans*). Canadian Journal of Zoology 81: 1392–1398.

Cadi, A. & Joly, P. (2004): Impact of the introduction of the red-eared slider (*Trachemys scripta elegans*) on survival rates of the European pond turtle (*Emys orbicularis*). Biodiversity and Conservation 13: 2511–2518.

Cadi, A., Delmas, V., Prévot-Julliard, A.-C., Joly, P., Pieau, C. & Girondot, M. (2004): Successful reproduction of the introduced slider turtle (*Trachemys scripta elegans*) in the south of France. Aquatic Conservation: Marine and Freshwater Ecosystems 14: 237–246.

Dimancea, N. (2013): Note upon the presence of *Trachemys scripta elegans* (Reptilia) in Oradea city, western Romania. Herpetologica Romanica 7: 41–47.

Džukić, G., Kalezić, M. & Mesaroš, G. (2008): Barska kornjača (*Emys orbicularis* L.) u donjoj Panoniji: prošlost, sadašnjost, budućnost. Savetovanje: "Stanje i perspective populacija barske kornjače u Vojvodini". pp. 1–29. In Proceedings of the Palić-Hajdukovo symposium "State and perspectives of the pond turtle populations i Vojvodina province". Subotica, September 9th 2008.

Gist, D. H. & Congdon, J. D. (1998): Oviductal sperm storage as a reproductive tactic of turtles. The Journal of Experimental Zoology 282: 526–534.

Kitowski, I. & Pachol, D. (2009): Monitoring the trade turnover of red-eared terrapins (*Trachemys scripta elegans*) in pet shops of the Lublin region, east Poland. North-Western Journal of Zoology 5: 34–39.

Kleewein, A. (2014): Natural reproduction of *Trachemys scripta troostii* (Holbrook, 1836) x *Trachemys scripta scripta* (Schoepff, 1792) in Austria. Herpetozoa 26: 183–185.

Lazarević, P., Stojanović, V., Jelić, I., Perić, R., Krsteski, B., Ajtić, R., Sekulić, N., Branković, S., Sekulić, G. & Bjedov, V. (2012): Preliminarni spisak invazivnih vrsta u Republici Srbiji sa opštim merama kontrole i suzbijanja kao potpora budućim zakonskim aktima [Preliminary list of invasive species in the Republic of Serbia with general measures of control and management, as a background to future legal acts]. Protection of Nature 62: 5–32.

Mali, I., Vandewege, M. W., Davis, S. K. & Forstner, M. R. J. (2014): Magnitude of the freshwater turtle exports from the US: long term trends and early effects of newly implemented harvest management regimes. PLoS ONE 9: e86478.

Marković, J. Đ. (1970): Geografske oblasti Socijalističke Federativne Republike Jugoslavije [Geographical regions of the Socialist Federal Republic of Yugoslavia]. Zavod za udžbenike i nastavna sredstva Srbije, Beograd.

Official Gazette of the Republic of Serbia 99/2009-26, 6/2014-9, Regulation on cross-border transport and trade of protected species: www.pravno-informacioni-sistem.rs/SlGlasnikPortal/pages/Package.xhtml#. Appendix VI, species referred to by the import prohibition of the paragraph 21 of the Regulation: www.pravno-informacioni-sistem.rs/SlGlasnikPortal/prilozi/prilog6.htm. Accessed on July 15, 2014.

Packard, G. C., Tucker, J. K., Nicholson, D. & Packard, M. (1997): Cold tolerance in hatchling slider turtles (*Trachemys scripta*). Copeia 1997: 339–345.

Pérez-Santigosa, N., Díaz-Paniagua, C. & Hidalgo-Vila, J. (2008): The reproductive ecology of exotic *Trachemys scripta elegans* in an invaded area of southern Europe. Aquatic Conservation: Marine and Freshwater Ecosystems 18: 1302–1310.

Polo-Cavia N, López, P., & Martín, J. (2008): Interspecific differences in responses to predation risk may confer competitive advantages to invasive freshwater turtle species. Ethology 114: 115–123.

Polo-Cavia, N., López, P. & Martín, J. (2011): Aggressive interactions during feeding between native and invasive freshwater turtles. Biological Invasions 13: 1387–1396.

Polo-Cavia, N., López, P. & Martín, J. (2012): Feeding status and basking requirements of freshwater turtles in an invasion context. Physiology and Behavior 105: 1208–1213.

Ramsay, N. F., Ng, P. K. A., O'Riordan, R. M. & Chou, L. M. (2007): The red-eared slider (*Trachemys scripta elegans*) in Asia: a review. pp. 161–174. In Gherardi, F. (eds.) Biological invaders in inland waters: profiles, distribution, and threats. Springer Publishing, The Netherlands.

Republic Hydrometeorological Service of Serbia, Annual Bulletin for Serbia 2013. Available at

www.hidmet.gov.rs/podaci/meteorologija/eng/2013.pdf.

Rödder, D., Schmidtlein, S., Veith M, & Lötters, S. (2009): Alien invasive slider turtle in unpredicted habitat: a matter of niche shift or of predictors studied? PLoS ONE 4: e7843. doi:10.1371/journal.pone.0007843.

Scalera, R. (2006): *Trachemys scripta.* From: DAISIE (Delivering Alien Invasive Species Inventories for Europe), www.europe-aliens.org. Accessed on July 14, 2014.

Scalera, R. (2007): Virtues and shortcomings of EU legal provisions for managing NIS: *Rana catesbeiana* and *Trachemys scripta elegans* as case studies. pp. 669–678. In Gherardi, F. (eds.) Biological invaders in inland waters: profiles, distribution, and threats. Springer Publishing, The Netherlands.

Semenov, D. V. (2010): Slider turtle, *Trachemys scripta elegans*, as invasion threat (Reptilia; Testudines). Russian Journal of Biological Invasions 1: 296–300.

Stevanović, V. (1992): Floristička podela teritorije Srbije sa pregledom viših horiona i odgovarajućih flornih elemenata. In: Sarić, M. R. (eds.): Flora Srbije 1: 47–56. Srpska akademija nauka i umetnosti, Beograd.

Tucker, J. K. (2000): Annual variation in hatchling size in the red-eared slider turtle (*Trachemys scripta elegans*). Herpetologica 56: 8–13.

Ultsch, G. R. (2006): The ecology of overwintering among turtles: where turtles overwinter and its consequences. Biological Reviews 81: 339–367.

Urošević, A., Tomović, L., Ajtić, R., Simović, A., Džukić, G. (in press): Alterations in the reptilian fauna of Serbia: introduction of exotic and anthropogenic range expansion of native species. Herpetozoa 28, scheduled for publishing in December 2015.

Valdeón, A., Crespo-Diaz, A., Egaña-Callejo, A. & Gosá, A. (2010): Update of the pond slider *Trachemys scripta* (Schoepff, 1972) records in Navarre (northern Spain), and presentation of the Aranzadi turtle trap for its population control. Aquatic Invasions 5: 297–302.

Vamberger, M., Lipovšek, G. & Gregorič, M. (2012): First reproduction record of *Trachemys scripta* (Schoepff, 1792), in Slovenia. Herpetozoa 25: 76–79.

van Dijk, P. P., Harding, J. & Hammerson, G. A. (2013): *Trachemys scripta*. The IUCN Red List of Threatened Species. Version 2014.1. www.iucnredlist.org, www.iucnredlist.org/details/22028/0. Accessed on July 7, 2014.