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First report on recording of the invasive species *Trachemys scripta elegans*, a potential competitor of *Emys orbicularis* in Latvia

Mihails Pupins*

Daugavpils University, p.k. 61, Daugavpils LV-5401, Latvia

*Corresponding author, E-mail: eco@apollo.lv

Abstract

An exotic turtle invasive species *Trachemys scripta elegans* Seidel 2002 was imported to Latvia with commercial purposes for sale in pet-shops. Now illegal introduction has resulted in invasion of the species into the nature of Latvia. In the study, the author checked reports from Latvian local inhabitants about their observation of *Trahemys scripta elegans* in Latvia. In five cases single animals were observed. In one case, for the first time in Latvia a group of six adult *Trahemys scripta elegans* individuals was observed in Sigulda area, village Nitaure. The problems of import of the invasive species *Trahemys scripta elegans* to Latvia and the subsequent illegal introduction of species in nature are examined and possible measures of preventing invasion of *Trahemys scripta elegans* are offered in Latvia.

Key words: *Emydidae*, invasive species, Latvia, *Trachemys scripta elegans*.

Introduction

The natural Latvian fauna includes only one species of turtles: European pond turtle *Emys orbicularis* L. (Silins, Lamsters 1934). Despite some observations of pond turtles in nature during last few years (Pupins, Pupina 1996; Meeske et al 2006) nothing is still known about any stable population of *Emys orbicularis* L. in Latvia (Pupins, Pupina 2005). At the same time, the exotic *Trachemys scripta elegans* Seidel 2002 fresh-water turtle species was massively and uncontrollably imported to Latvia (Pupins, unpublished data), as well as to many other European countries with commercial purposes for sale in pet-shops (Obst 1983; Cadi et al. 2004; Pendlebury 2006). Synonyms: *Chrysemys scripta elegans* Boulenger 1889, *Emys elegans* Wied 1839, *Emys holbrooki* Gray 1844, *Emys sanguinolenta* Gray 1855, *Pseudemys scripta elegans* Stebbins 1985, *Trachemys lineata* Gray 1873 (Obst 1983; Pendlebury 2006).

The natural area of distribution of *Trachemys scripta elegans* is the Mississippi Valley area (USA; Pendlebury 2006). *Trachemys scripta elegans* occupies different types of waters: ponds, rivers, lakes with developed vegetation, warmed up by the sun. The species is omnivorous, feeds on aquatic and terrestrial plants, insects, mollusks, amphibious, fish, crustaceans, and worms. It grows up to 15 - 35 cm long (Obst 1983). It reproduces laying from three to 11 eggs (Pendlebury 2006). Sexual maturity is reached in the 3rd to 4th year (Obst 1983; Pupins, unpublished data).

In XX - XI centuries *Trachemys scripta elegans* was actively grown on farms and massively imported to other countries due to its biological features, attractive appearance and behavior and cultural-historical traditions (raising turtles at home, terrarium keeping, use of turtles in food; Pendlebury 2006) in Europe. According to statistics, 448 000 juvenile *Trachemys scripta elegans* were imported to Poland during 1994 - 1997 (Najbar, Bartlomiej 2001).

For some reason, there occurred an illegal and inadvertent introduction of the species into nature of the importing countries. Where climatic conditions were suitable for the species, it has successfully adapted into nature. According to the data of the Invasive Species Specialist Group which collects and studies the information about invasive species, *Trachemys scripta elegans* is now found in 21 countries of the world: Australia, Bahamas, Bermuda, Brazil, Costa Rica, France, Guam, Italy, Japan, Korea, Republic of Micronesia, Federated States of (FSM), New Zealand, Northern Mariana Islands, Poland, Spain, Taiwan, Thailand, United Kingdom (UK), United States of America (USA), Viet Nam (Vietnam), Virgin Islands, British (Pendlebury 2006), Bangladesh, and India. There is information on the stable existence of *Trachemys scripta elegans* groups and other exotic turtles species in Germany (Schneeweis 2002; Drews 2005) and in cultural habitats of Russia (Pupins, unpublished data).

This wide spread of the species and its influence on local habitats has led to its inclusion in the list of the hundred most invasive biological species of the world (Lowe et al. 2000). In Europe *Trachemys scripta elegans* is a competitor of *Emys orbicularis* in basking places (Cadi, Joly 2003). Spread of invasion of *Trachemys scripta elegans* in Latvia, besides the influence of this species on the habitat, can result in a direct competition of the species with the extremely rare Latvian species of turtles *Emys orbicularis* (Pupins 2005; Pupins, Pupina 2005). This raises a need for research on the occurence of *Trachemys scripta elegans* in Latvia.

Methods

Research on the distribution of turtles was carried out throughout the whole territory of Latvia. Other specific habitats were surveyed additionally, after receiving reports from inhabitants about their observations of *Trachemys scripta elegans* in Latvia.

The search for *Trachemys scripta elegans* was carried out in Latvia together with the study of the distribution and ecology of turtles in Latvia, where the target species of research was European pond turtle *Emys orbicularis* (Pupins 2005).

The basic method of primary research of the distribution of *Trachemys scripta elegans* in Latvia was questioning of local people about observation of turtles in nature. Particular attention was paid to population groups such as: (i) people professionally connected with nature conservation: environmental, forest guards, protected territory workers; (ii) people who regularly use natural resources for their material needs or in their work: amateur hunters and fishermen, forest workers, land owners; (iii) people taking interest in published information concerning nature: the magazine and newspaper articles about nature, radio, television, Internet; (iv) people in contact with nature: tourists, schoolchildren, zoo visitors, etc. The initial question to participants of the survey regarding the observation of turtles in Latvia was asked in the following ways.

(i) Oral form (direct interview of teachers, students, zoo visitors etc) since 1982. The

number of oral questioned people was 30796 in total: 54 in 1982; 52 in 1983; 36 in 1984; 48 in 1985; 123 in 1986; 220 in 1987; 2236 in 1988; 1583 in 1989; 1568 in 1990; 2641 in 1991; 1562 in 1992; 2240 in 1993; 2221 in 1994; 2363 in 1995; 2344 in 1996; 1167 in 1997; 1200 in 1998; 1285 in 1999; 1264 in 2000; 658 in 2001; 356 in 2002; 368 in 2003; 1356 in 2004; 1287 in 2005; 2564 in 2006.

(ii) In written form by direct questions to readers of publications on turtles in Latvia in different local media, radio, TV since 1995.

(iii) Beginning with the year 2005, survey was also conducted by a questionnaire specially designed for the research (Lidaka et al. 2005). The given questionnaire was both preliminary and an independent method of research. It included the following: a question regarding the observation of turtles in Latvia, pictures of *Trahemys scripta elegans*, and recommendations on observation of turtles. The questionnaire included a form for filling in an observation of turtles in Latvia. The form contained questions of geographical-ecological and ethological nature. The survey participants were paid in advance for filling in the survey, which made the work with the population more effective (Lidaka et al. 2005). The number of questioned people in the survey carried out through the newspapers, booklets, TV and radio can not be exactly calculated. After receiving the participant's positive answer, an obligatory telephone or personal interview with the survey participant was organized.

After receiving an affirmative answer to the initial question concerning the observation of turtle in Latvia, the survey participant was offered to choose the animal he saw among the colored pictures of turtles *Emys orbicularis*, *Trahemys scripta elegans* and *Agrionemys horsfieldi* (Lidaka et al. 2005). Also additional questions were given regarding the observation. All the positive answers about the observation of any turtle species were checked.

Depending on the year of the observation and time of receiving the data, an initial examination of the water body and habitat was carried out (Inger 1994; McDiarmid 1994) as well as the examination of the nearest water body if the turtle was seen on the land.

Fig. 1. Observations of *Trahemys scripta elegans* in Latvia in 2006.

Results

We received and checked six reports from Latvian inhabitants about their observation of *Trahemys scripta elegans* in Latvia. Messages were received from the following areas: Daugavpils: (i) N 55°52', E 26°30'; (ii) N 55°52', E 26°35'; (iii) N 55°49', E 26°29'; Sigulda: (iv) N 57°06', E 25°17'; Valmiera: (v) N 57°32', E 25°25', (vi) N 57°31', E 25°24' (Fig. 1). The greatest number of reports (n = 3) was received from the Daugavpils area. In Valmiera District, within an interval of four months, the same animal was repeatedly reported.

In five cases single animals were observed. In one case, in Sigulda area, village Nitaure, a group of adult *Trahemys scripta elegans* individuals was observed for the first time in Latvia (Table 1).

In Sigulda area (Nitaure village), six adult large individuals of *Trahemys scripta elegans* were observed. Five individuals from the given group were captured by local inhabitants. Three of them were examined by the author. All were adult large females (Table 2). The carapaxes of all surveyed turtles were symmetric, without any traces of a scoliosis or other anomalies of development, often found in *Trahemys scripta elegans* grown in terrariums by beginners (Pupins, unpublished data). All turtle carapaxes had numerous fine scratches.

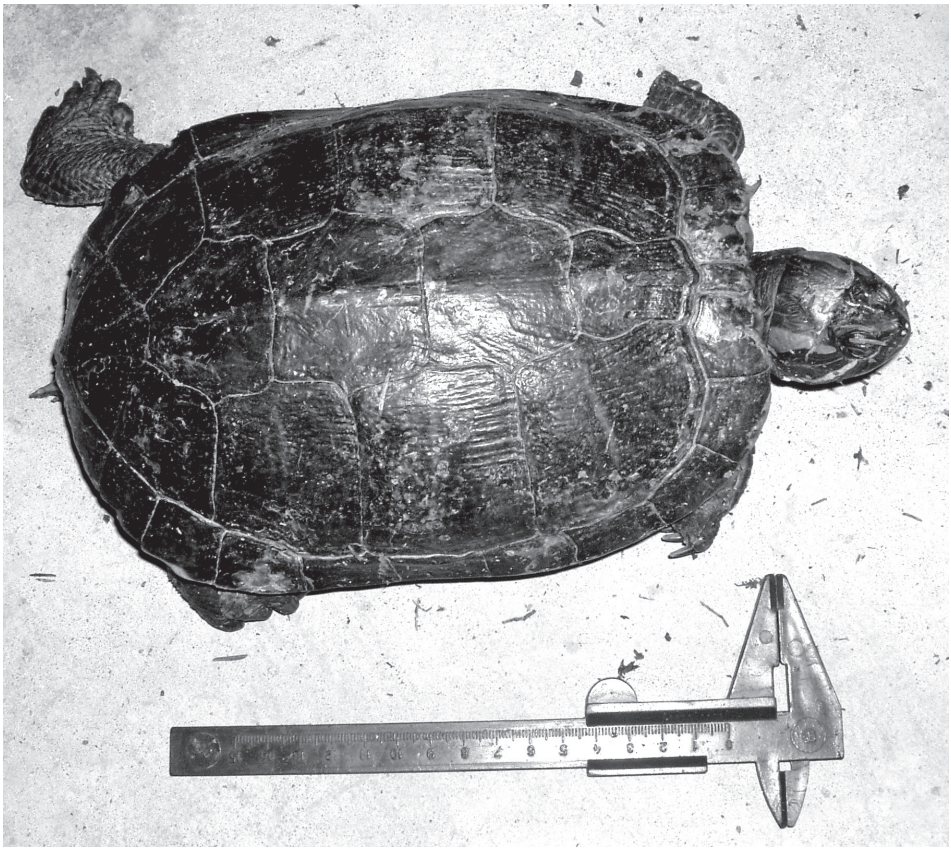

Fig. 2. Female *Trahemys scripta elegans*, captured in Sigulda area, Nitaure village, 2006.

There was a growing wound on the head of one female, presumably from traumatic influence of anthropogenous character (a scar in the form of a direct line; Fig. 2).

Two waterbodies with *Trahemys scripta elegans* records were reported: districts of Daugavpils and Sigulda (village Nitaure).

Waterbody 1. Region: Daugavpils. One adult *Trahemys scripta elegans* was observed in former fish-breeding ponds in the area of Daugavpils (local name of the area "Elektroinstruments", N 55°52', E 26°35'). The habitat represents a system of channels and ponds of artificial origin that were used previously for fish cultivation. The system includes dams and sluices. The depth is up to 3 - 4 m. The eutrophic level is high. The shore zone is warmed and is densely covered with reed and other near-water plants. There are also open shore sites. The shore is bordered by sandy hills. About 20 % of the shore is covered by coniferous and mixed wood. There is plenty of fish, many water birds. There was a report of observation of an adult *Emys orbicularis* individual in 1985 in same location (Pupins, unpublished data). There are abandoned buildings, operating industrial premises and gravel roads at the distance of 20 to 100 m from the shore. Roads also are along shore of the waterbody. The area is actively used by local residents for recreational purposes, walking with dogs and fishing. Due to the length of the shore line, there are sites inaccessible by people (Fig. 3).

Waterbody 2. Region: Sigulda (Nitaure village). A group of six adult *Trahemys scripta elegans* was observed in a pond with local names "Dzirnavinu dikis", "Dzirnavinas" N 57°06', E 25°17'). The habitat is an old pond earlier used for cultivation of carp. The poorly flowing pond formed possibly as a result of blocking a small forest river. The ground is clay. Water depth is up to 3 m. The shore is shaded and eutrophic level is high. The water is densely covered with water plants and the shore with mixed wood and bushes. There are fallen trees in the water. There is an open place on the southern shore used by *Trahemys scripta elegans* for sun basking. There is some household debris on the shore, as the waterbody is used by inhabitants for fishing. There is an operating country farm at the distance of 100 m. There is a gravel road along the shore of the waterbody (Fig. 4).

Table 1. Observations of *Trachemys scripta elegans* in Latvia

District	Year of observation	Reports	Animals observed
Daugavpils	2006	3	3
Sigulda (Nitaure)	2006	1	6
Valmiera	2006	2	2
Total		**6**	**11**

Table 2. The sizes of adult *Trachemys scripta elegans* captured in Latvia (Sigulda area, Nitaure village, 2006)

The individual	Sex	Carpax length (mm)	Carpax with (mm)
1	Female	214	144
2	Female	217	164
3	Female	212	174

Fig. 3. Part of a pond system where *Trahemys scripta elegans* was observed in Daugavpils city, Elektroinstruments, 2006.

The above observations confirm records of the invasive species of *Trahemys scripta elegans* in Latvia since 2006. The species is present as individuals and as a group of adult animals.

Discussion

Reliability of records of species by inhabitants and completeness of the received data

Three animals caught in Sigulda (Nitaure village)were examined by the author. Certainly, the received data is incomplete because only those animals about which the inhabitants informed were considered. It is possible to assume the existence of single individuals and groups of *Trahemys scripta elegans* in Latvia that have not been observed by inhabitants or about whom the author had not been informed. Some sellers of pet-shops claimed that during 1990 - 2000 several thousands of juvenile *Trahemys scripta elegans* were imported to Latvia, for sale in pet-shops (Pupins, unpublished data).

The reasons of import of Trahemys scripta elegans *to Latvia and the subsequent illegal introduction of the species in the nature*

Trahemys scripta elegans is not used in food or for other economic purposes in Latvia. This species is imported to Latvia for keeping as pets. Usually they are attractive juvenile animals with 3 - 5 cm carapace length, green carapax and bright red spots on the head. In

Fig. 4. Waterbody where the first group (six individuals) of adult *Trahemys scripta elegans* was found in Latvia, in Sigulda district, Nitaure village, 2006.

some cases, there are also *Trahemys scripta elegans* with a length of carapace 10 - 15 cm on sale, which were given by previous owners for subsequent resale (Pupins, unpublished data). In spite of the fact that education of owners is low and during the first or second year after purchase about 50 % of animals perish, some *Trahemys scripta elegans* grow up to 10 - 15cm (Pupins, unpublished data). The larger individuals have problems of maintenance: need for a greater aquarium volume, better filtration, aggression of adult turtles, need for more forage, greater expenses for electricity for heating (Obst 1983), reduction of animal attractiveness, also comprehension by the owner that this animal will live with him/her for many years. Therefore, many Europeans give their *Trahemys scripta elegans* to zoos, also in Latvia (Riga Zoo, Latgale Zoo), but some turtle owners prefer to release the animal in nature. The author has reports on two cases of successful runaway of *Trahemys scripta elegans* into nature, when owners were walking with them outside (Pupins, unpublished data).

Ability of Trahemys scripta elegans *to adapt to the environment in Latvia*

Obvious limiting factors for the species are low mid year and seasonal temperatures in Latvia. A group of more than 30 *Trahemys scripta elegans* with a length of carapax more than 10 cm has for several years been raised by the author in a pool in the natural climate of Latvia from April until October. Animals that are well adapted for the Latvian climate are active, feed, grow and do attempts to copulate (Pupins, unpublished data). Similar

adaptation of *Trahemys scripta elegans* to the German climate has led to the species being the most often met exotic species in nature (Drews 2005). The ability of *Trahemys scripta elegans* to winter under the ice in waterbodies in Latvia seems obvious as well. However, the author lacks data on wintering *Trahemys scripta elegans* in Latvia, in March - April 1995 - 1999 he repeatedly observed a group of 8 - 12 adult *Trahemys scripta elegans* individuals with a length of carapace not less than 20 cm that were wintering in unwarmed ponds of the Moscow Zoo, Russia, Moscow, N 55°44', E 37°39' (Pupins, unpublished data). *Trahemys scripta elegans* winters successfully in Germany (Schneeweis 2002).

Hatching times are weather dependent: temperatures between 22 to 30 °C for 55 - 80 days are preferred (Pendlebury 2006). Successful reproduction of *Trahemys scripta elegans* is recorded in southern France (Cadi et al. 2004). The average sum of temperature in Latvia is obviously insufficient for incubation of *Trahemys scripta elegans* eggs naturally, as well as for regular successful incubation of egg laying of *Emys orbicularis* in Latvia (Pupins 2005). In this regard there are only single cases of observation of juvenile *Emys orbicularis* in Latvia (Kocane 1999; Pupins, unpublished data). At the same time, regarding potential invasion of *Trahemys scripta elegans* in Latvia, it is necessary to consider the warm autumn-winter periods in Latvia, the general tendency of change of mid-annual temperatures in Europe, and also the long life of *Trahemys scripta elegans*.

Possible measures of preventive maintenance of invasion

Possible measures of preventive maintenance of invasion of *Trahemys scripta elegans* in Latvia are:

(i) education to Latvian inhabitants about the danger of release of *Trahemys scripta elegans* into nature;

(ii) informing Latvian inhabitants about *Trahemys scripta elegans* biology;

(iii) creation of a *Trahemys scripta elegans* shelter in Latvia for receiving turtles from inhabitants;

(iv) further research on *Trahemys scripta elegans* distribution and ecology in Latvia;

(v) removal of *Trahemys scripta elegans* in places of their observation;

(vi) restriction of import of *Trahemys scripta elegans* to Latvia.

Partially the given measures are now implemented by the Rigas Zoo and Latgale Zoo. In 2007 in Latgale Zoo housed 67 adult *Trahemys scripta elegans* received from local inhabitants (Pupins, unpublished data).

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Invazīvās sugas *Trachemys scripta elegans*, potenciālā *Emys orbicularis* konkurenta, pirmais atradums Latvijā

Mihails Pupiņš*

Daugavpils Universitāte, p.k. 61, Daugavpils LV-5401, Latvija
*Korespondējošais autors, E-pasts: eco@apollo.lv

Kopsavilkums

Eksotisko invazīvo sugu *Trachemys scripta elegans* Seidel 2002 ieved Latvijā komercāliem mērķiem pārdošanai zooveikalos. Notiek nesankcionēta sugas introdukcija un invāzija Latvijas dabā. Pētījuma rezultātā iegūti un pārbaudīti seši ziņojumi no Latvijas iedzīvotājiem par *Trachemys scripta elegans* novērojumiem Latvijā. Piecos gadījumos novēroti atsevišķi īpatņi, bet vienā gadījumā, pirmo reizi Latvijā, novērota *Trachemys scripta elegans* sešu pieaugušu īpatņu grupa Siguldas apkārtnē Nītaures ciema tuvumā. Rakstā analizētas invazīvās sugas *Trachemys scripta elegans* importa Latvijā un sekojošās nesankcionētās sugas introdukcijas dabā problēmas, piedāvāti iespējamie pasākumi, kuri varētu novērst *Trachemys scripta elegans* invāziju Latvijā.