Acta Biol. Univ. Daugavp., Suppl. 3, 2012: 82 – 90.
ISSN 1407 – 8953

INVASIVE FISH *PERCCOTTUS GLENII* IN BIOTOPES OF *BOMBINA BOMBINA* IN LATVIA ON THE NORTH EDGE OF THE FIRE-BELLIED TOAD'S DISTRIBUTION

Aija Pupiņa[1], Mihails Pupiņš[2]

[1,2]Latgales Zoo, Daugavpils, Latvia, bombinalatvia@inbox.lv
[1]Institute of Ecology, Daugavpils University, Daugavpils, Latvia

ABSTRACT

In the result of the carried out study since 2004, *Perccottus glenii* was found in 5 basins in Latvia, inhabited by *Bombina bombina*, situated in Daugavpils district and belonging to three populations: *Ilgas*, *Demene*, *and Medumi*. All the localities are situated on the south-eastern part of Latvia, at a distance of no more than 1-2 km from the borders with Lithuania and Belarus. The long-term (no less than 2 seasons) presence of *Perccottus glenii* in a small reservoir causes the disappearance of *B. bombina* tadpoles, as well as larvae of other amphibians.

Key words: *Perccottus glenii*, *Bombina bombina*, invasive species, Latvia

INTRODUCTION

Populations of fire-bellied toad *Bombina bombina* in Latvia determine the northern edge of species' distribution in European Union (Gasc et al., 1997; Kuzmin, et al., 2008) and are significant for preserving the common boundaries of *Bombina bombina* area. The first small population of fire-bellied toad is known in Latvia since 1922, it is situated in Bauska district, Islices pagasts (Grosse & Transehe, 1929, Siliņš & Lamsters, 1934). Ģ.Kasparsons in 1966 found a second population of fire-bellied toads in Daugavpils district, Skrudaliena pagasts, where they were constantly registered thereafter (Kasparsons, 1972). These two small *Bombina bombina* populations (7-10 vocalizing males each) were the only verified findings of fire-bellied toads in Latvia for decades (Gasc et al., 1997).

Studies of the distribution and the size of *Bombina bombina* population in Latvia, conducted by the authors of the article since 2004, enabled to find and describe new populations and localities of *Bombina bombina* during the time period from 2004 to 2008 in Daugavpils and Aizkraukle districts, with a total number of 196 vocalizing *Bombina bombina* males in Latvia in 2008 (Pupina et al., 2008).

All known populations of *Bombina bombina* in Latvia are small and located in the southern and south-eastern part of the country near the borders with Lithuania and Belarus. Out of them, only two historically known populations of *Bombina bombina* in Latvia: *Ilgas* (Daugavpils district), *Islice* (Bauska district) are situated in the territories that are listed among Natura 2000 territories. The major part of the remaining populations and localities are situated on unprotected territories and therefore are subjected to an unlimited influence of various negative factors.

Since 1997 Bombina bombina in Latvia is protected by the law "On the Berne Convention

of 1979 on the Protection of Wildlife and Biotopes in Europe". Bombina bombina is also included in *"The List of Especially Protected and Restrictedly Used Especially Protected Animals of Latvia" (Noteikumi par īpaši aizsargājamo sugu un ierobežoti izmantojamo īpaši aizsargājamo sugu sarakstu,* 14.11.2000. No. 396). The extreme paucity of fire-bellied toad in Latvia was the basis for including it in the Red Data Book of Latvia (Bērziņš, 2003), where it was assigned to the 1st category. In 2007 the "Protection Plan of Fire-bellied Toad Bombina bombina in Latvia" was developed and officially approved by the Ministry of Environment of Latvia (Pupiņš & Pupiņa, 2006), in which the main factors affecting the safety of *Bombina bombina* in Latvia had been described.

One of the factors, ascertained for Latvia, is the presence of invasive species of fish *Perccottus glenii* (Dybowski 1877) in reservoirs (Pupiņš & Pupiņa, 2006). The natural habitat of its distribution is the Far East of Russia, North-east China, and northern North Korea (Reshetnikov, 2009). *Perccottus glenii* is an invasive species in Europe and now is noticed in many European countries: Serbia, Bulgaria, Hungary, Ukraine, Slovakia, Romania, Belarus, Finland, Italy, Estonia, Moldavia, Poland, Germany, Lithuania (Kosco et al., 2003; Nalbant et al., 2004; Reshetnikov, 2005; Novak et al., 2008; Kosco, 2009; Reshetnikov, 2009; Semenchenko et al., 2009; Ureche et al., 2009), extends the natural habitat in Russia (Polakov & Buzmakov, 2008).
Perccottus glenii (rotans in Latvian) is an invasive species of fish in Latvia too. For Latvia a single point is marked in Daugavpils district, probably in Bauska district, Cesis district, Riga district and Valmiera district (*Percottus glehni* Dyb., 2006). Perccottus glenii, as flexible and predatory species with a wide range of trophic features, is a serious danger for amphibians and their larvae (Reshetnikov, 2005). Such danger may be more pronounced if small populations of amphibians inhabit small reservoirs, as Bombina bombina does in Latvia on the north of natural habitat (Pupina & Pupins, 2007). This makes the study of distribution of Perccottus glenii in Latvia on the territories of cohabitation with Bombina bombina relevant, as well as the analysis of the cases of Perccottus glenii invading reservoirs, inhabited by Bombina bombina and especially located on the territories of Natura 2000.

MATERIALS AND METHODS

The study of the distribution of *Perccottus glenii* in Latvia on the territories inhabited by *Bombina bombina* is carried out by the authors since 2004, as a constituent part of the constantly ongoing study of the distribution and ecology of *Bombina bombina* in Latvia. The explored territory was the southern and south-eastern regions of Latvia, on which *Bombina bombina* populations were found: Daugavpils district, Bauska district, and Aizkraukle district. The search of *Perccottus glenii* was carried out in ponds, inhabited by *Bombina bombina*, as well as in the nearest reservoirs, situated at a distance of no more than 100 m from them or in a common water system, connected with them (streams, canals, flooding during high water). To minimize the influence of search procedure on the biotope pond, we used a net fishing. The used net was 30 cm in diameter, mesh size 1 x 1 mm.

The investigation of each reservoir was repeated no less than 5 times a year in 2004 – 2009, at least 1 person/hour per reservoir. The fishing was carried out by mowing of aquatic vegetation in different zones of reservoir. Caught fish were determined to species. Identification of *Perccottus glenii* was accomplished according to the key of Kuznecov B.A. (1974). To determine the reasons for introduction and consideration of general distribution of *Perccottus glenii* on the territories located near the reservoirs, inhabited by *Bombina bombina*, as well as in the administrative regions of Latvia, we interviewed fishermen, local people, ichthyologists and conservation workers. Meanwhile we checked their ability to identify *Perccottus glenii*.

The search of *Bombina bombina* was carried out by the method of accounting of vocalizing males' voices (Zimmerman, 1994). The registration was carried out in warm weather from 10:00 to 22:00 in the spring-summer season, no less than 6 person/hours per biotope a year. Moreover, the visual recording (Crump & Scott, 1994) of juvenile individuals, tadpoles, adult males and females, as well as the visual recording of eggs and accounting of tadpoles by the sweep-net method were used. *Bombina bombina* tadpoles since 26th stage (Reproductive Biology and Phylogeny of Anura, 2003) were identified by the characteristic stripes on the head and back (personal consultation M. Deicmane, with the authors' additions). Eggs clutches of *Bombina bombina* were determined visually according to the method developed by the authors: 1) according to the arrangement of the eggs clutch in basin, 2) according to the number of eggs in a clutch and 3) according to the shape of eggs clutch.

RESULTS

Perccottus glenii in biotopes of *Bombina bombina*. In the result of the carried out study, *Perccottus glenii* (Figure 1) was found in 5 basins in Latvia, inhabited or historically previously inhabited by *Bombina bombina* (Figure 2). All *Bombina bombina* localities, colonized by *Perccottus glenii*, are situated in Daugavpils district and belong to three populations: *Ilgas*, *Demene*, *and Medumi*.

Figure 2. *Bombina bombina* localities, colonized by *Perccottus glenii*, in Latvia.

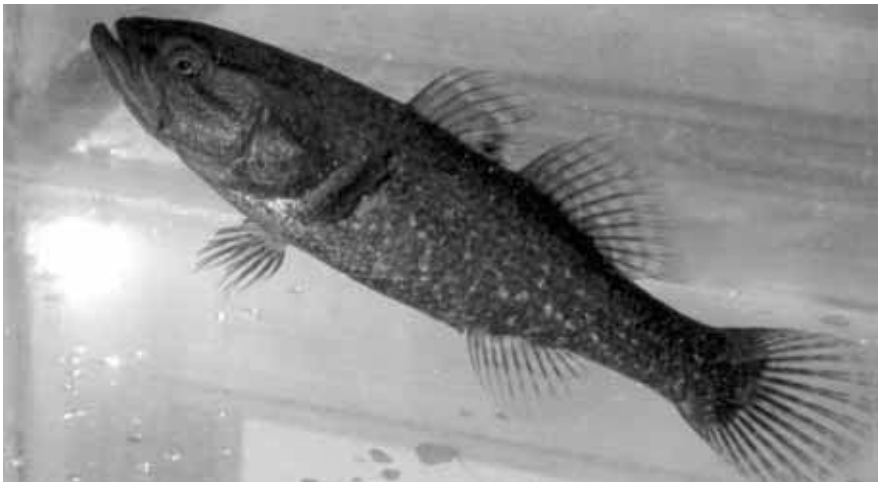

Figure 1. *Perccottus glenii*, caught in the biotope of *Bombina bombina*. *Ilgas* localization, NATURE 2000 Territory.

Table 1.

The quantity of vocalizing *Bombina bombina* males in 2004 - 2009 in the colonized by *Perccottus glenii* biotopes in Latvia.

* - this year *Perccottus glenii* was registered in the biotope;

- - this localization was not found this year

No.	Localization and population	Coordinates	Number of *B. bombina* males in years					
			2004	2005	2006	2007	2008	2009
1	Apalais dikis *Ilgas*	N 55°41'89" E 26° 46'63" h 160 m	6	3*	1*	0*	1	0
2	Kavaliski 2 *Demene*	N 55°41'23" E 26°32'21" h 132 m	-	-	-	7	17	27*
3	Ozolaine 3 *Medumi*	N 55°44'67" E 26°19'96" h 129 m	-	-	-	4*	2*	0*
4	Bebru kanals *Medumi*	N 55°44'50" E 26°20'07" h 127 m	-	-	-	0*	5*	24*
5	Ozolaine 9 *Medumi*	N 55°44'52" E 26°19'54" h 138 m	-	-	-	-	-	13*

All the localities are situated on the south-eastern part of Latvia, at a distance of no more than 1-2 km from the borders with Lithuania and Belarus. The evolution of vocalizing *Bombina bombina* males' quantity in the biotopes, as well as natural disappearance of *Perccottus glenii* from the biotope in *Ilgas* localization is marked in the study (Table 1).

The situation in *B. bombina* "Apalais dikis" localization (population *Ilgas*, Nature 2000). The biotope is situated in Nature reserve "Ilgas" (Territory Nature 2000) in the Nature Park "Silene". This is a natural pond (Figure 3) with variable sizes in the course of year (in spring 50 m x 35 m x 1.70 m), at the end of summer it gets dry. The reservoir is surrounded by mixed forest. The bottom is argillaceous. The pond is characterized by a broad littoral, occasionally up to 8 m wide, overgrown with *Carex vesicaria*. The reservoir serves as a biotope of natural habitat and breeding of numerous *Rana temporaria, Rana arvalis, Pelophylax lessonae, Bufo bufo, Bufo viridis, Pelobates fuscus, Triturus cristatus, Lissotriton vulgaris, Bombina bombina*. In spring, when snow melts, a stream flows into the reservoir, which contains beaver dikes. In autumn and winter 2004 - 2005 a level of water remained high in the pond. In 2005 *Perccottus glenii* was found in the reservoir for the first time. In the same year *Lissotriton vilgaris'* larvae were met in the reservoir: up to 5 pcs. by each netting; larvae of other amphibians were not found, although juveniles of *Bufo bufo* were met on the shore. In 2006 only few *Pelobates fuscus* tadpoles with bitten tails and 3 adults *Triturus cristatus* were found in the pond. In 2006, after the complete natural drying of the pond, 82 dead *Perccottus glenii* (L < 8 cm) were found in it. In spring 2007 a large population of *Perccottus glenii* hatchlings (L ~ 1.2 cm) was noted in the pond.

In 2007 in the course of LIFE-Bombina project's implementation a single juvenile of *Bombina bombina* (L=20mm) was found by specialists during the inspection of the pond. The authors have not found in the pond larvae of previously spawning in it any species of amphibians. On June 29th up to 7 *Perccottus glenii* were caught by each sweeping of the net. In August 2007 the pond dried up completely. In 2008

Figure 3. The *Bombina bombina* biotope of *Ilgas* population, Nature 2000 Territory.

Perccottus glenii was not found in the pond. On May 30th, 2008 a single *B. bombina* male was vocalizing in the pond (first vocalization after beginning of *P.glenii* invasion). In 2009, according to biology students' observation, 1 *B. bombina* hatchling was found in the pond (identified by R. Cibulskis). In summer 2009 the pond dried up again.

The situation in *B. bombina* "Bebru kanals" localization (population *Medumi* Nature 2000). In 2007 in Medumi municipality in village Ozolaine a population of *B. bombina* was noted. By the first inspection of the stream with several beaver dikes 1 last year's juvenile of *B. bombina* (L=27 mm) and 1 *P.glenii* (L=90 mm) were caught simultaneously. Subsequent inspections discovered a large *P.glenii* population in this canal together with *Carassius carassius*. In 2008 in the present biotope 5 *B. bombina* males were vocalizing, and in 2009 - 24, but eggs or tadpoles were not found. Vocalizing *B. bombina* localized mainly (n=23) on canal's sections, heavily overgrown with vegetation.

The situation in *B. bombina* "Ozolaine 3" localization (population *Medumi* Nature 2000). In June 2007 a landowner dug two new ponds at a distance of 50 m from "Bebru kanals" localization. One of it is 40 m x 20 m x 3 m in size; it is connected by small canals, dug by beavers, with *Bebru kanals*, which is inhabited by *Perccottus glenii* and *Carassius carassius*. In 2007 in the present pond 4 quietly vocalizing *B. bombina* and a large population of *B. bombina* tadpoles (5 tadpoles per 1 m of shoreline) were fixed. Larvae of other species of Amphibia were not found, although on the shore the density of *Pelophylax lessonae* was approximately 6 individuals per 1 m of shoreline. In august, before the beginning of *B. bombina* metamorphosis, a numerous population of *Perccottus glenii* was fixed in the pond: at the water surface a shoal of about 30 fish (L < 15 cm) could be observed. Many *B. bombina* tadpoles, inspected in august, were injured: out of 92 inspected Tadpoles 12 (13%) had damages of caudal fin (Figure 4). *B. bombina* with bitten off tails that in the process of metamorphosis were taken to the laboratory,

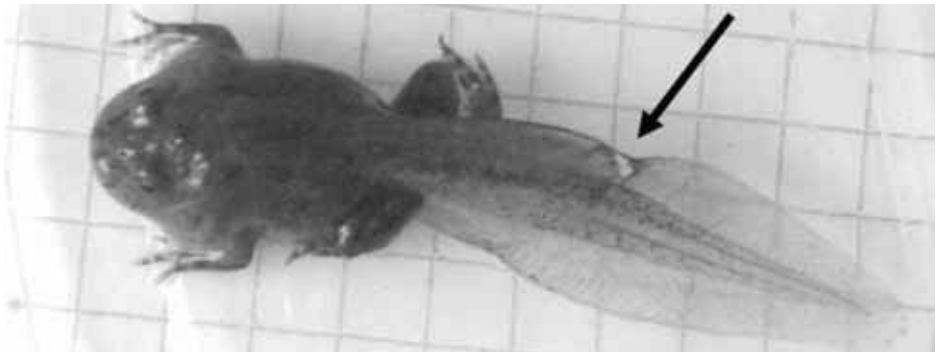

Figure 4. *B. bombina* in the process of metamorphosis with a damaged tail (2007.08.31.).

died. Tadpoles were situated mostly on the southern shore of the pond; very close to the water line, in the littoral zone without plants that was 10-20 cm wide and 1-5 cm deep. In deeper areas tadpoles were not found. In 2007 a single individual of *B. bombina* was met at the water line under a piece of soil.

In 2008 two quietly vocalizing *B. bombina* males were found in the reservoir, as well as 3 hibernated juveniles. 27 *Pelophylax lessonae* were registered on the shore. On July 7th one nonvocalizing *B. bombina* male was caught by net, on July 26th 1 sub-adult and 1 adult *B. bombina* were met on land, in clefts of the soil at a distance of 2-6 m from water, larvae of any species of Amphibia were not fixed in the reservoir. In 2009 *B. bombina* were not found in the reservoir.

However, in the second new pond that is 15 m x 7 m x 2,5 m in size, dug in 2007 at a distance of 15 м from the first one, into which, according to the landowner, no fish were released, 4 *B. bombina* males were vocalizing, 3 females were found, and a large population of tadpoles was found. Already in 2008 only 2 quietly vocalizing *B. bombina* males were fixed there, in May a single juvenile *B. bombina* was met, on July 7th 3 larvae of *Triturus cristatus*, but not any tadpole were found. In 2009 not any *B. bombina* male was vocalizing in the pond. Perhaps the owner of the pond released fish into it.

The situation in *B. bombina* "Ozolaine 9" localization (population *Medumi* Nature 2000). In the biotope – flooded by a steam deepening of relief (6 m x 12 m), in 2009 on July 14th 13 vocalizing *B. bombina* were found, hatchlings of *Perccottus glenii* were found on the shore. *B. bombina* tadpoles or larvae of other species of Amphibia were not found. With that, at a distance of 100 m in a small garden ditch (100 cm x 20 cm x 20 cm) *B. bombina* male and female were found, as well as 1 tadpole.

The situation in *B. bombina* "Kavaliski" localization (population *Demene*). The biotope is highly structured; there are many boughs nibbled by beavers in the reservoir, and it is connected with a fishing pond by a stream. In the present localization 7 vocalizing *B. bombina* males were registered in 2007, in 2008 - 17, and in 2009 - 27. However, eggs or tadpoles were not found. In 2009 in the present biotope (millpond *Castor fiber*, 100 m x 50 m in size) *Perccottus glenii* was fixed.

The introduction of *Perccottus glenii* in *B. bombina* reservoirs. While interviewing local residents and fishermen in Latvia, we found out that *Perccottus gle*nii is often used by them as bait for catching the local predatory fish (*Esox lucius, Perca fluviatilis*). *P.glenii* is capable of great endurance when transporting, stays alive and moving on the hook for a long time, so locals often release unused *Perccottus glenii* in lakes and rivers. Also, fishermen bring

Perccottus glenii often on purpose and release it in ponds located near the places of catching the predatory fish, to facilitate their search for bait hereafter (A. Viguls, personal comments). We also learned from the questioning of landowners that usually villagers deliberately let fishes in new created ponds, which previously had no fishes. Usually these are *Carassius carassius*, but the accidental release of unnoticed *Perccottus glenii* is possible.

DISCUSSION

The carried out studies have shown that *Perccottus glenii* inhabit biotopes of *B. bombina* in Latvia. After the invasion of *Perccottus glenii, B. bombina* ceases to spawn successfully in the biotope, eggs or tadpoles cannot be usually observed in it, although, in the absence of other reservoirs nearby, *B. bombina* males can continue to vocalize in the biotope. Such vocalization may become quieter. It can be assumed that *B. bombina* avoids being in the reservoir, which is inhabited by *Perccottus glenii*, as well as tadpoles avoid spreading throughout the reservoir.

The long-term (no less than 2 seasons) presence of *Perccottus glenii* in a small reservoir causes the disappearance of *B. bombina* tadpoles, as well as larvae of other amphibians. Still *B. bombina* may choose close reservoirs that environmentally are of little use for them but free from fish yet. In the colonized by *Perccottus glenii* reservoir vocalizing *B. bombina* chooses highly structured (with many plants and boughs) parts of the biotope. Even in a relatively large localization of *B. bombina*, in the biotope, were *Perccottus glenii* is fixed, no eggs or tadpoles are found. The simultaneous presence of *Perccottus glenii* and *B. bombina* tadpoles in the biotope can indicate that *Perccottus glenii* has appeared in the biotope relatively not long ago.

The south-eastern part of Latvia has a large number of reservoirs of different types and sizes, which are often connected by soil-reclamation canals. A high level of snow in winter and a rapid snowmelt in spring cause heavy high water, in the result of which the reservoirs of *B. bombina* and *Perccottus glenii* may be temporarily connected. Also, a temporarily or permanent connection of reservoirs, which are inhabited by the present two species, may be due to the impounding by beavers of *Castor fiber* one of the reservoirs (usually that one, which is inhabited by *Perccottus glenii*). At present, beavers are widely distributed in Latvia and inhabit almost all available reservoirs. In both cases, *Perccottus glenii* gets into the biotope of *B. bombina*. However, a deliberate and accidental introduction by people may cause the appearance of *Perccottus glenii* in the biotopes of *B. bombina* in Latvia. The present studies suggest that the invasion of *Perccottus glenii* in Europe threatens the small populations of *B. bombina* on the north edge of area in Latvia.

ACKNOWLEDGEMENTS

We thank LIFE+ Project LIFE09NAT/LV/000239 "Conservation of rare reptiles and amphibians in Latvia", Institute of Ecology of Daugavpils University, Daugavpils City Council. We thank H.Drews (Germany); L.Brigs (Denmark), M.Deicmane, A.Skute (Latvia), A.Reshetnikov (Russia) for the consultations and cooperation.

REFERENCES

Bērziņš, A. 2003. Sarkanvēdera ugunskrupis *Bombina bombina* Linnaeus, 1761 [Fire-bellied toad *Bombina bombina* Linnaeus, 1761]. Latvijas Sarkanā grāmata. Retās un apdraudētās augu un dzīvnieku sugas. 5. sējums. Zivis, abinieki, rāpuļi [Red Data Book of Latvia. Volume 5. Fishes, Amphibians, Reptiles]. Galv.red. G. Andrušaitis. Rīga, 82-83. (In Latvian)

Crump, M. L. & Scott, N. Jr. 1994. The research by visual observation. Heyer, W. R., Donnelly, M. A., McDiarmid, R. W., Hayek, L. A. C. & M. S. Foster (eds.): Measuring and Monitoring

Biological Diversity Standard Methods for Amphibians. Smithsonian Institution Press, Washington, DC, 84-92.

Gasc, J. P., Cabela, A., Crnobrnja-Isailovic, J., Dolmen, D., Grossenbacher, K., Haffner, P., Lescure, J., Martens, H., Martz Rica, P. J., Maurin, H., Oliveira, E. M., Sofianidou, S. T., Veith, M.& Zuiderwijk, A. 1997. Atlas of Amphibians and Reptiles in Europe. Societas Europaea Herpetologica and Muséum National d'Histoire Naturelle, Paris, 496 p.

Grosse, A. & Transehe, N. 1929. Austrumbaltijas mugurkaulaino saraksts [Eastern Baltic spineless list]. Rīgas Dabaspētnieku Biedrības darbi, XVIII burtnīca, 14-16. (In Latvian)

Reproductive Biology and Phylogeny of Anura. 2003. Volume 2. Editor B.G.M. Jamieson. Science Publishers, Inc., Enfield, New Hampshire, U.S.A., 462 p.

Kasparsons, Ģ. 1972. Jaunas mugurkaulnieku sugas Latvijā [New vertebrate species in Latvia]. Dabas un vēstures kalendārs 1973. Zinātne, Rīga, 148-149. (In Latvian)

Kosco, J. 2009. Non-native fishes in the Middle Europe, a review. Aquatic biodiversity international conference, Sibiu, Romania, European Union, 3-4.

Kosco, J., Lusk, S., Halacka, K. & Luskova, V. 2003. The expansion and occurrence of the Amur sleeper (*Perccottus glenii*) in eastern Slovakia. Folia Zoologica 52, 3: 329-336.

Kuzmin, S. L., Pupina, A., Pupins, M. & Trakimas, G. 2008. Northern border of the distribution of the red-bellied toad (*Bombina bombina*). Zeitshrift fur Feldenherpetologie 15: 1-14.

Kuznecov, B. A. 1974. Guide of Vertebrates of the USSR Fauna [Определитель позвоночных животных фауны СССР]. Part 1. Prosveshchenie Publishers, 190 p. (In Russian)

Noteikumi par īpaši aizsargājamo sugu un ierobežoti izmantojamo īpaši aizsargājamo sugu sarakstu [The List of Especially Protected and Restrictedly Used Especially Protected Animals of Latvia]. MK noteikumi Nr. 396, 14.11.2000. Latvijas Vēstnesis, 17.11.2000, nr. 413/417. (In Latvian)

Nalbant, T., Battes, K., Pricope, F. & Ureche, D. 2004. First record of the Amur sleeper *Perccottus glenii* (Pisces, Perciformes: Odontobutidae) in Romania. Travaux du Museum National d'Histoire Naturelle "Grigore Antipa", XLVII: 279-284.

Novak, M., Szcerbik, P., Tatoj K. & Popek, W. 2008. Non-native freshwater fishes in Poland: an owerview. Aquaculture, Aquarium, Conservation & Legislation International Journal of the Bioflux Society 1, 2: 173-191.

Percottus glehni Dyb., 2006. Internetenciklopēdija "Latvijas Daba" [Internet Encyclopedia "Nature of Latvia"]. © A. Kļaviņš, SIA Gandrs, [online]. Available from: http://www.latvijasdaba.lv/zivis/percottus-glehni-dyb/ [Accessed 2006]

Polakov, A. D. & Buzmakov, G. T. 2008. Capture danger of Amur sleeper (*Perccottus glenii*) in reservoirs of Siberia [Опасность захвата ротаном (*Perccottus glenii*) водоемов Сибири]. Scientific Journal of Fundamental Research 6, 98-99. (In Russian)

Pupina, A. & Pupins M. 2007. A new *Bombina bombina* L. population "Demene" in Latvia, Daugavpils area. Acta Universitatis Latviensis, 273, Biology, 47-52.

Pupina, A., Pupins, M. & Berzins, A. 2008. New data on the distribution of *Bombina bombina* in Latvia on the northern edge of its area. Biologia plazow i gadow – ochrona herpetofauny. IX Ogólnopolska Konferencja Herpetologiczna. Kraków, Poland, 194-198.

Pupiņš, M. & Pupiņa, A. 2006. Sarkanvēdera ugunskrupja *Bombina bombina* (Linnaeus, 1761) sugas aizsardzības plāns Latvijā [Conservation plan of the European Fire-bellied Toad *Bombina bombina* (Linnaeus, 1761) in Latvia] Dabas aizsardzības pārvalde, Latgales Ekoloģiskā Biedrība, Daugavpils, 82 lpp. (In Latvian)

Reshetnikov, A. 2005. Introduced fish, rotan *Percottus glenii* – an unavoidable threat for European amphibians. FrogLog 67: 3-4.

Reshetnikov, A. N. 2009. The current range of Amur sleeper *Perccottus glenii* Dybowski, 1877 (Odontobutidae, Pisces) in Eurasia [Современный ареал ротана *Perccottus glenii* Dybowski, 1877 (Odontobutidae, Pisces) в Евразии]. Russian Journal of Biological Invasions 1: 22-34. (In Russian)

Semenchenko, V. P., Rizevsky, V. K., Mastitsky, S. E., Vezhnovets, V. V., Pluta, M. V., Razlutsky, V. I. & Laenko, T. 2009. Checklist of aquatic alien species astablished in large river basins of Belarus. Aquatic Invasions 4, 2: 337-347.

Siliņš, J. & Lamsters, V. 1934. Latvijas rāpuļi un abinieki [Latvian reptiles and amphibians]. Rīga, Rapa, 96 lpp. (In Latvian)

Ureche, D., Battes, K. & Ureche, C. 2009. Research regarding the distribution of the invasive species *Perccottus glenii* Dybowski 1877 (Pisces: Osteichtes) within the uppear midbasin of the river Siret, Romania. Aquatic biodiversity international conference, Sibiu, Romania, European Union, 34.

Zimmerman, B. 1994. The account of voices on the tape transects. Heyer, W. R., Donnelly, M. A., McDiarmid, R. W., Hayek, L. A. C. & M. S. Foster (eds.). Measuring and Monitoring Biological Diversity Standard Methods for Amphibians. Smithsonian Institution Press, Washington, DC, 70-74.