

## Reintroduction of the European Tree Frog (*Hyla arborea*) in Latvia

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### 1. Introduction

It is a well-known fact that reintroduction of species, together with restoration and/or protection of the essential biotopes, is a central aspect of nature protection. Several important international agreements and guiding documents on nature conservation such as the Bern Convention, also stress the need for reintroduction of endangered species. Zoological gardens and parks play an important role in this process, because they are able to provide breeding *ex situ*, in order to create a reserve for further release into the natural habitats of the species (*in situ*). 'The World Zoo Conservation Strategy', prepared in 1993 by The World Zoo Organisation and The Captive Breeding Specialist Group of IUCN/SSC, is fully devoted to this problem.

Aiming at this particular aspect of nature conservation, Laboratory of Ecology was founded in the Riga Zoo in 1987. It started the project to reintroduce the Tree Frog (*Hyla arborea* L.) to Latvia in 1988. The Latvian Fund For Nature joined the project since 1990.

The Tree Frog is listed in the Red Data Book of Latvia under Category I (endangered species) (Latvijas PSR Sarkanā grāmata 1985). Data on the distribution of the Tree Frog in Latvia are rather incomplete (Latvijas PSR Sarkanā grāmata 1985; Siliņš un Lamsters 1934). Several faunists of German origin (Fischer, Seidlitz, Schweder) have mentioned the species as being present in Latvia in the XVIII–XIX centuries, the vicinities of Riga and even the northeastern part of Latvia being given as

localities for this species. Additional observations have been reported during this century, especially during the first half. Several reports from southwestern Latvia (Liepāja region) and Vidzeme (Madona region) have even been received in the 1980s. *Hyla arborea* was last heard calling in 1968, on lake Pape, which is located in the southwestern corner of Latvia (ca. 56°05'N).

Many experts consider the Latvian distribution and past records on *Hyla arborea* to be doubtful. One of the main arguments against is the absence of a single preserved specimen in museum collections. We do not consider this assumption to be convincing, because it is not very realistic to think that all the researchers confused and muddled the Tree Frog, which has a rather characteristic appearance, with another anuran.

More serious are arguments, based on the fact, that the northern distribution for present stable localities is situated several hundred kilometres south from Latvia (Arnold and Burton 1979) (however, one locality was recently reported from Lithuania). The closest large and stable *Hyla arborea* population is located in Western and Southern Belarus (mainly south of 54°N). At the same time, it should be mentioned that, according to several sources, the Tree Frog also occurs in Skåne (Southern Sweden), as far north as 58°N. These localities usually accommodate 5 000 to 8 000 adult specimens (Ahlén et al. 1992).

We think that there are no theoretical grounds to oppose the claim that, in recent past, the northern border of the Tree Frog's area of distribution also

included Latvia. A change in climatic conditions does not explain the decline of the population, because no significant climate changes have been recorded since 1795, when regular meteorological observations in Latvia were started (Latvijas PSR mazā enciklopēdija 1969). Climatic conditions in the area selected for reintroduction and in the closest present localities of the species are relatively similar, as can be concluded from the table (Table 1).

In our view the crucial factor influencing the decline of the Tree Frog population in Latvia was a rapid deterioration in total area covered mainly by wetlands, which resulted in a subsequent lack of breeding habitats. The main reason for the reduction of wetlands was the gradually increasing intensity of agriculture that occurred during the end of last century and at the beginning of this century. The changes in agriculture were determined by the land ownership changes which took place after 1860 and by the land use reform, which was started in 1920 and continued till the Second World War. Intensification of agriculture, in turn, led to destruction of the natural landscape. It is well known that any species is especially vulnerable on the border of its distribution area. We contend that land use changes caused insularisation of the distribution area at its northern border. It is proven that anthropogenic influence has a much stronger negative effect on population dynamics following its insularisation. Fragmentation of the population in itself can cause rapid decline (Yablokov, 1987).

A second factor which caused deterioration of wetlands, and which may in turn have had a negative impact on the Tree Frog's population, is extinction of beaver (*Castor fiber*) in Latvia. According to different sources, last beavers disappeared

from Latvia in 1855 or 1871. Beavers from Norway were reintroduced to Latvia in 1927, and from Voronezh (Russia) in the 1950s (Tauriņš, 1982); beavers are now numerous and widespread throughout the country. According to our data, dikes, canals or trails in dense vegetation of overgrown ponds, and the subsequent changes in the water regime caused by beavers, are creating and preserving habitats suitable for *Hyla arborea*.

We believe, that intensification of agriculture and the disappearance of the beaver together caused the Latvian wetlands to deteriorate to an extent that was enough to shift the northern border of Tree Frog's distribution area to the south of Latvia.

## 2. Material and methods

The adult specimens needed for our reintroduction work were caught in Southern Belarus, near the confluence of Goryn and Pripyat rivers. The average length of the adults received from Belarus was 43.0 mm for males and 44.4 mm for females; average weight 6.13 g and 8.06 g respectively. The animals were placed in outdoor terraria. They were fed with artificially bred *Musca domestica*, *Gryllus* sp., *Galleria mellonella* as well as Calliphoridae and Sarcophagidae flies collected in the wild. At the end of October–beginning of November, the animals, in wooden boxes filled with *Sphagnum*, were placed in a refrigerator (average temperature +5°C) to hibernate. The hibernation continued till the end of January–beginning of February. After hibernation the Frogs were intensively fed and the artificial daylight period was gradually lengthened, imitating the day length of the breeding period. The

Table 1. Comparison of climatic characteristics between the reintroduction area and the two closest existing Tree Frog populations (Climate of the Belorussian SSR 1976; Pasaules zemes un tautas 1978; Climatic Atlas of the Latvian SSR 1972).

	Southern Belarus	Southern Sweden	Reintroduction locality (LV)
Average temperature January (°C)	−6 to −7	0 to −5	−4
Average temperature July (°C)	+18	+15 to +17	+16.5
Average number of days with snow coverage	80	below 30	90
Average number of days without frost	160–170	N/A	140
Average number of days with temperature above 5°C	195–205	N/A	190
Average snow/rainfall yearly (mm)	550	600–800	750

animals were daily exposed to soft UV or normal UV light (1 hour and 0.5 hour, respectively).

Breeding was stimulated with hormone injections given during the first year at the beginning of May and already in the beginning of March in other years; in both cases the results were virtually identical. Two males and one female were usually placed in a 35 l aquarium with a water level of about 5 cm and several water plants, under room temperature.

A synthetic analogue of luliberin - surphagon (D-alanil<sup>6</sup>, dez-glicilamid<sup>10</sup>, L-propiletilamid<sup>9</sup>, produced by Bapex company, Latvia) was used to stimulate breeding. Synthetic analogues of luliberin are known to be up to 1 000 times more effective than the natural hormone (Ge *et al.* 1986). These substances are successfully used to stimulate the breeding of anurans in Moscow Zoo as well.

The concentration used was 100 mg in 1 ml of Ringer solution. The solution was injected into the side lymphatic sack. Females received injections in the morning, 15 to 20 mg at each injection; males — usually received 10 mg in the evening. If spawning did not start after the first injection, the whole procedure was repeated 24 hours later. In several cases up to 3–4 injections were needed. Each female produced 200 to 800 eggs. Hatching usually started on the 8th–10th day of development. Larvae were placed into a 35 l or 100 l aquarium with aeration and heater; the density never exceeded 2–3 larvae per litre. Heaters were usually switched off during the night. Luminescent 40 W lamps were switched on and off automatically, imitating the natural photoperiod. Night temperatures were 20–23°C, day temperatures 24–27°C.

Tadpoles were fed *ad libitum* with dried and boiled nettles, meat, aquarium fish food (Tetra) and pollen. Tadpoles which spent much time in the upper part of the aquarium tank had a clear preference for pollen, which can also be part of the natural diet for this species (Wagner 1986).

Tadpoles which began to metamorphose (forelegs appeared) were removed to low plastic tanks with very shallow water, where they stayed till full resorption of the tail. Following metamorphosis, Froglets were measured and weighed and then transferred to terraria similar to the ones for adults. Froglets were fed with wild captured Diptera and with laboratory bred *Drosophila*, *Gryllus* and, later, also with *Musca domestica*. Two to six weeks later the Froglets were ready to be taken to the reintro-

duction site.

The average length of metamorphosed Froglets was 13.8±0.1 mm, the average weight being 398±5 mg. Some specimens even reached a size of more than 18 mm and a weight of 600–700 mg. The metamorphosis (starting from hatching) took 30 to 60 days (under natural conditions it is usually 90 days). The average amount of animals that metamorphosed was 60–70% of the initial larvae; in some cases it even exceeded 90%. As under laboratory conditions it is possible to achieve breeding earlier than in the wild, and as the period of metamorphosis is considerably shorter in the laboratory, the released Froglets had the opportunity to feed and grow for a longer duration till autumn. We hypothesize that this could result in a much higher survival rate during the Froglets' first winter as well.

The area chosen for the reintroduction programme is located in southwestern Latvia, in the region of Liepāja (ca. 56°30'Nl.), where a protected area totalling 125 hectares was created for this purpose. Abandoned farmlands account for the bulk of the area. The dominating forest types are *Hylocomiosa*, *Myrtilloso polytrichosa*, and *Dryopterioso caricosa*. The area accommodates a large number of anthropogenic and natural ponds (some of them formerly were used for fish breeding, but have been abandoned for a couple of decades). Most of them have been considerably changed by beavers. The banks are overgrown with *Salix*, *Alnus*, and *Rubus*, the lower level is dominated by *Carex*, *Equisetum*, *Phragmites*, *Acorus*, *Scirpus*, *Juncus*, and *Iris*. Several watercourses are completely overgrown with these plants; there is free water only along the coasts and in the canals, made by beavers. The climatic characteristics of the area were given above.

The Froglets were released in June–July; in several cases also in August. The site of release was the same each year. During 1988–1992, a total of 4 110 juveniles were released (in 1988–571 ind.; 1989–663; 1991–1860; 1992–1016).

The development and distribution of the newly created population was monitored mainly on the basis of the spring breeding calls. The first time a Tree Frog male was heard calling on May 1<sup>st</sup>, 1990, which shows that under particular conditions males can reach sexual maturity in two years.

### 3. Results

The results of this reintroduction programme proved the following:

1. *Hyla arborea* can normally hibernate in the climatic conditions of Latvia. Six winters passed since the reintroduction began. The first five winters were comparatively mild, with little or even no snow, and with frequent frost. However, winter of 1993/94 was extremely cold; temperature frequently stayed below  $-20^{\circ}\text{C}$  for longer period, and there was not much snow. Nevertheless, especially in spring 1994, calling was very active during the breeding season and also the calling period itself was much longer than usual: calling was recorded from 26 April to 14 June.
2. In the wild, released Froglets reach sexual maturity and can successfully breed. Tadpoles were found at the reintroduction site for the first time in July 1991. Thus, under these conditions, females can reach sexual maturity in three years. Tadpoles were also observed in 1992–94.
3. Tree Frogs are spreading around the site they were released initially. The first calling males outside the pond where the juveniles were initially released, were observed in spring 1993. In 1994 calling males were recorded in seven different ponds; some of them are situated more than 2 km from the original reintroduction site. Tadpoles were also found in one of these distant ponds.

Our experience proves that it is possible to restore a stable *Hyla arborea* population in Latvia. Unfortunately, it is difficult to estimate the present size of the population.

Future observations of the reintroduction area

are planned for the coming years. Possibility of selecting the second reintroduction site in another part of Latvia where the microclimate and biotopes would be suitable, has considered as well. Finally, it must be stressed that serious attention should also be paid to the legal status of the reintroduction sites, especially by establishing protected areas there.

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### References

- Ahlén I., Andrén C., Nilson G. 1992: Sveriges grodor, ödlor och ormar. — Naturskyddsrensningen, Stockholm.
- Climate of the Belorussian SSR. — Minsk Hydro-meteorological Observatory, 1976 (In Russian).
- Pasaules zemes un tautas. — Zvaigzne, Rīga 1978. (In Latvian)
- Climatic Atlas of the Latvian SSR. — Zvaigzne, Rīga 1972. (In Russian).
- Ge I.J., Qin X.D. et al. 1986: Further aspects of gonadotropin-releasing hormone research. — Biopolymers 25:255–266
- Latvijas PSR Sarkanā grāmata. — Zinātne, Rīga 1985 (In Latvian).
- Latvijas PSR mazā enciklopēdija. — Zinātne, Rīga 1969., 2. sēj. — 78. lpp. (In Latvian).
- Siliņš J., Lamsters V. 1934: Latvijas rāpuļi un abinieki. — Valtera un Rapas akc. sab., Rīga. (In Latvian).
- Yablokov, A.V. (Яблоков, А.В.) 1987: [Population Biology. — Visshaya shkola, Moscow] (In Russian).
- Tauriņš E. 1982: Latvijas ziditājdzīvnieki. — Zvaigzne, Rīga.
- Wagner W.E.Jr. 1986: Tadpoles and pollen: observations on the feeding behaviour of *Hyla regilla* larvae. — Copeia 3: 802–804.