Can reservoirs compensate oxbow disappearance? The amphibian fauna of the Rétközi reservoir and the Várközi oxbow lake

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1 Introduction

According to comparative analyses the sixth extinction wave on Earth is happening now (Chapin et al., 2000). Amphibians are one of most endangered animals; one third of the known species are threatened by extinction making it a global problem (IUCN et al., 2008). There are a lot of reasons behind this process ranging from global climate change and wide-spread diseases (Pounds et al., 2006) to habitat disappearance and vehicular traffic (Puky et al., 2005). In Europe the main cause is the loss and alteration of habitats. This is especially true for riparian floodplain habitats along large European rivers mainly because they have been regulated during the past two centuries; often even the remaining parts have been altered by various human use. As a consequence, their former function in the life of amphibians has been limited. To compensate previous habitat loss, it is an urgent task to protect still existing, and to create new, amphibian habitats. This makes monitoring of amphibian populations in riparian habitats a most important scientific and conserving activity. While along the Hungarian stretch of the River Danube a long-term data series exists (Puky, 2007), only scattered studies on the floodplain of its largest tributary, the River Tisza are available (Marián, 1960, 1963, 1977; Gyovai, 1989; Wubbenhorst et al., 2000). However, sound monitoring is being applied, a method satisfying modern requirements of scientific and environmental-friendly ecological surveys. This paper summarises the results of 2009 surveys on the amphibian fauna of a reservoir and a nearby semi-natural oxbow along the River Tisza in Hungary.

2 Study area

Field work was made in Szabolcs-Szatmár-Bereg county, Hungary, along the upper stretch of the River Tisza (Figure 1). The Rétközi reservoir (48º16'30" N, 22º01'50" E) was built in 1990 replacing a marsh which could not be used for agriculture or other purposes as inundation occurred regularly. The reservoir is 4 km long and 1-1.5 km wide with a surface of 400 hectares. It was built to regulate inundation and floods and is connected to three inundation canals and to the River Tisza. It is near Szabolcsveresmart and partly surrounded by woods of hybrid black poplars and locust trees and agricultural fields.

Várközi oxbow lake is a nearby semi-natural habitat on the other side of the village. It is 1.1 km long and 55 m wide on average with a water surface of 6 hectares. Its average depth is 1.5 m. It is well overgrown with macrophytes and has no direct connection to the River Tisza, but is regularly fed by floods of the river. In summer it often dries out (Pálfai, 2001). It has the quality of a nature reserve and protection was suggested by Wittner et al. (2005).

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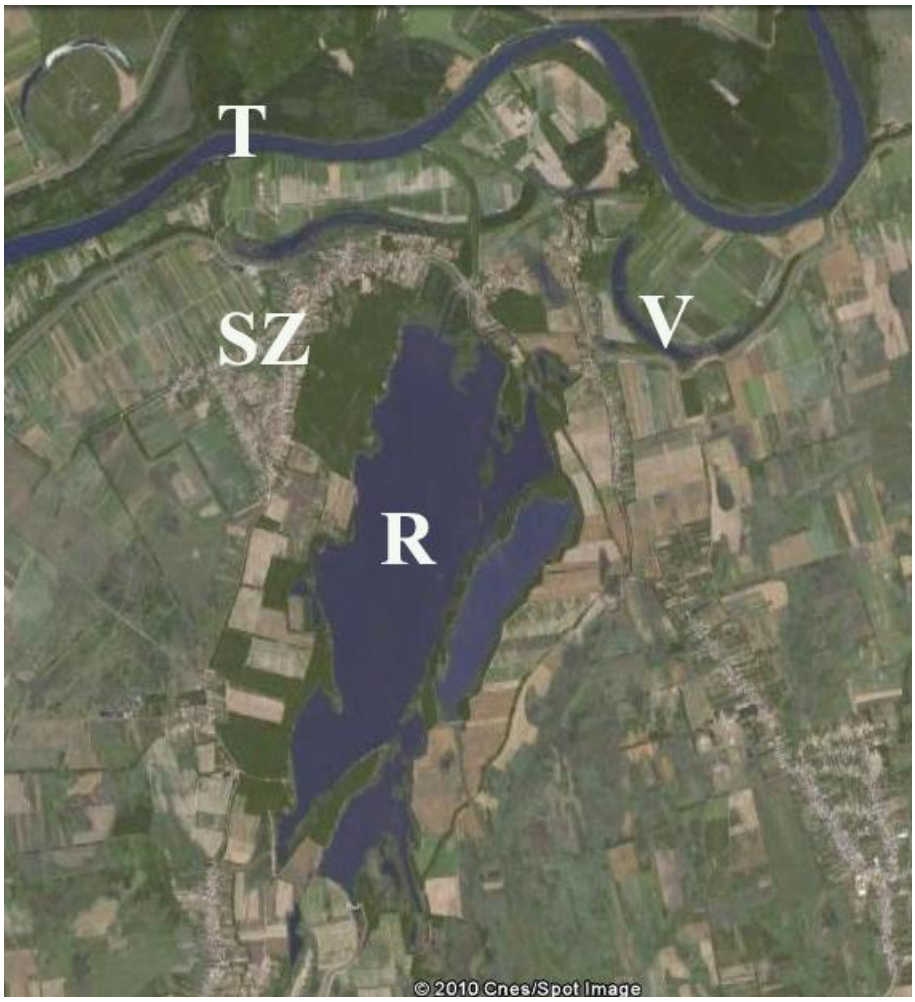

Figure 1. *Satelite image of the Rétközi reservoir (R) and the Várközi oxbow lake (V). (T = River Tisza, SZ = Szabolcsveresmart village)*

3 Methods

Sound monitoring is used from 1981 (Mossman et al., 1998) and is part of North American Amphibian Monitoring Program (NAAMP) and Marsh Monitoring Program (MMP) (Weeber & Vallianatos, 1999). These studies have been carried out at the Great Lakes with the aim of determining amphibian population size and following annual changes. In Europe, similar studies were carried out in the Netherlands (Smit et al., 2000) and in Switzerland (Pellet & Schmidt, 2005). The adaptation of this method for Hungary was made in the the Monitor2000 programme producing the manual and recorded sounds for species identification (Anthony & Puky, 2001).

Sound monitoring was performed in 2009 during the breeding period (March-July) of anurans according to Anthony & Puky (2001). Five surveys were necessary because species croak in different periods. Ten sampling stations were selected along the reservoir and five along the oxbow lake, 500 m apart. Surveys started 30 minutes after sunset if conditions (e.g. wind speed) were appropriate. At each sampling station the observers listened for five minutes and noted species presence, the intensity and direction of the calls. We used the Wisconsin index to characterise the calling intensity of the frogs and toads (Mossman et al., 1998). The call index is 1, if individuals can be counted and there is pause between the calls. It is 2, if calls of individuals are distinguishable but some calls overlap. It is 3 if there is a full chorus, i.e. calls are constant, continuous and overlapping. In addition, weather conditions were recorded and the distribution of habitats from which anuran calls could be heard were mapped during the day. Besides sound monitoring, visual encounter surveys and night searches were also applied in detecting the presence of amphibians. Cluster analysis with Ward method was used on the basis of species heard at the stations, and their call index.

4 Results

Bombina bombina, Bufo bufo, Epidalea viridis, Hyla arborea, Pelophylax ridibundus, Pelophylax lessonae, Pelophylax kl. esculentus were detected in distinct periods. During the first survey (28 March, 2009) no amphibians were calling but green toads (Epidalea viridis) were found migrating to their breeding habitats. Nine days later a full chorus of the European tree frog (Hyla arborea) and the European fire-bellied toad (Bombina bombina) could be heard from the Rétközi reservoir as well as from the Várközi oxbow lake, while common toads (Bufo bufo) only called from the reservoir. During the third survey (25 April, 2009) the first calling individuals of edible frogs (Pelophylax kl. esculentus) were detected together with species already indicated in previous surveys. During the fourth survey (24 May, 2009) mainly edible frogs called in the reservoir, while in the oxbow lake green toads, edible frogs and pool frogs (Pelophylax lessonae) were recorded. During the last survey (3 July, 2009) only P. kl. esculentus could be heard. The presence of moor frogs (Rana arvalis) and common spadefoots (Pelobates fuscus) could only be detected with visual encounter surveys and night searches but not with sound monitoring.

5 Discussion

Sound monitoring worked well in the detection of amphibians along the River Tisza in Hungary. It was especially effective in detecting *H. arborea* and *B. bombina* populations, and it also turned out to work well in separating the species of the *Pelophylax* complex. *R. arvalis* and *P. fuscus* were not detected by sound monitoring, because they call from underwater and their sounds are low, consequently they can only be heard from nearby. The call intensity of Rétközi reservoir and the Várközi oxbow lake amphibian communities were significantly different from each other (Figure 2). However, there were two exceptions: H1 station appeared in the reservoir group, and T5 was similar to oxbow stations. It seemed to be caused by habitat-related characteristics, at H1 the terrestrial vegetation (hybrid black poplars) is similar to those of the reservoir stations while at T5 the aquatic vegetation (mainly reed) resembles to the habitats of the oxbow lake.

The occurrence of species was different at the two sites. *H. arborea* and *E. viridis* were more abundant at the oxbow lake, while *B. bufo* was only heard at the reservoir. The rarest amphibian in the survey, the pool frog could only be found at the oxbow lake (this separation was also proved by an ongoing genetic investigation). It is the smallest species of the *Pelophylax* complex outcompeted by other members of the group; its survival seems to depend primarily on the habitat offered by the semi-natural oxbow lake. As this species is known to disappear from riparian habitats along rivers in Europe, such as the valley of Rhine in Switzerland because of habitat degradation (Lippuner & Heusser, 2001), its protection is of special concern.

During the coming years several new reservoirs are planned in the framework of the New Vásárhelyi Plan, a river-regulation oriented programme along the Hungarian stretch of the River Tisza. They can be valuable habitats for protected and endangered amphibians if some areas are formed with similar attributes to an oxbow lake. Also, due to their high conservation value, oxbow lakes must be placed under stricter protection than today.

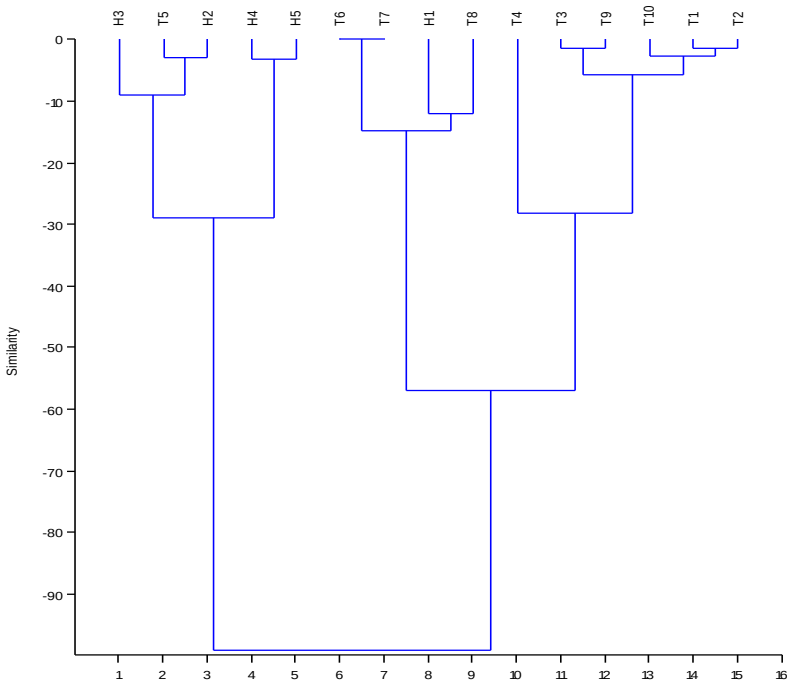

Figure 2. *Cluster analysis comparing sampling stations based on Wisconsin index (T= reservoir, H= oxbow lake, numbers indicate stations)*

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