

Frogs in the city: problems of research and conservation of amphibians in Lobau (Vienna, Donau-Auen National Park)

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Abstract

Lobau is part of the floodplain of the Danube River in Vienna. Due to river engineering, hydrodynamics are constrained and vary greatly among different sections. We synthesize results of recent surveys of amphibians, highlighting the challenges for research and conservation. Habitat availability and abundances may differ markedly between years. Population studies spanning several years are urgently needed. Reproduction of amphibians often is highest in temporary water bodies. Extreme dynamics may be disadvantageous, however, as quickly drying ephemeral pools become reproductive sinks and major floods may bring fish to formerly fish-free waters. Lobau is still home of viable populations of several endangered amphibian species. To secure or even improve their situation, habitat management should increase ground water levels and maintain or enhance water level dynamics. Restoration efforts aimed at increasing connectivity of water bodies must take great care to avoid deterioration of amphibian breeding habitats.

Keywords

population dynamics, distribution, habitat restoration, floodplain, wetland

Introduction

Riverine floodplains are highly dynamic habitats. For amphibian populations, recurrent changes in water levels are important factors determining habitat quality and availability.

Lobau is part of a floodplain of the Danube River in Vienna, and part of the Donau-Auen National Park. Due to river engineering, hydrodynamics are constrained and vary greatly among different sections. In connection with measures to improve flood protection, management options to improve the ecological conditions have recently been analysed; the goals of fostering hydromorphic dynamics and conserving existing macrophyte-rich habitats can hardly be achieved at the same time (RECKENDORFER et al. 2012).

We synthesize results of recent studies that were carried out at different spatial and temporal scales, aiming to address the following questions:

Which challenges for research on amphibians are posed by the dynamics of the habitat?

Does this area achieve the aim of protecting biodiversity, judged by the status of amphibian populations?

How can habitat management secure or improve the situation of endangered amphibian species?



Figure 1: Records of *Triturus dobrogicus* (yellow dots), obtained in surveys on 62 days from 7 April to 25 September 2009 (© H. Schedl).

Methods

Standard methods applied in all studies included visual and auditory surveys and dipnetting. Because spawn and larvae of water frogs (*Pelophylax* spp.) cannot be determined to species, they were pooled. For mapping the distribution of *Triturus dobrogicus* in 2009 also bottle-traps and torch surveys were used. In mark-recapture studies, *Bombina bombina* were individually registered by photographing their ventral patterns.

Results

Distribution

Intensive surveys in 2009, a wet year, showed that *Triturus dobrogicus* occurred in 39 water bodies throughout Lobau, in 23 of which evidence for reproduction (eggs or larvae) was found (Fig. 1). In a few locations where this species was recorded in the 1990s no newts were observed; formerly stagnant pools had been converted into flowing channels inhabited by fish. During these surveys, *Rana arvalis* was observed in 11 water bodies, *Pelobates fuscus* in 18 locations; most of these sites (8 and 14, respectively) were also inhabited by *T. dobrogicus* (SCHEDL et al. 2009).

Seasonal abundance patterns

Seasonal abundance of amphibians varies greatly, especially in temporary water bodies. Whereas several species enter water mainly for breeding, and are terrestrial during most of their activity period, *Bombina bombina* are largely aquatic also as adults. In large temporary pools with strong variation in water level the number of observed toads fluctuated greatly throughout a season (Fig. 2). On 11 July 2008, when the water level had decreased rapidly, not a single individual was detected at the study site. Many toads returned later when it started to rain heavily. At very high water levels, capture probability decreased due to increased flight distance and mobility of the toads in free water bodies.

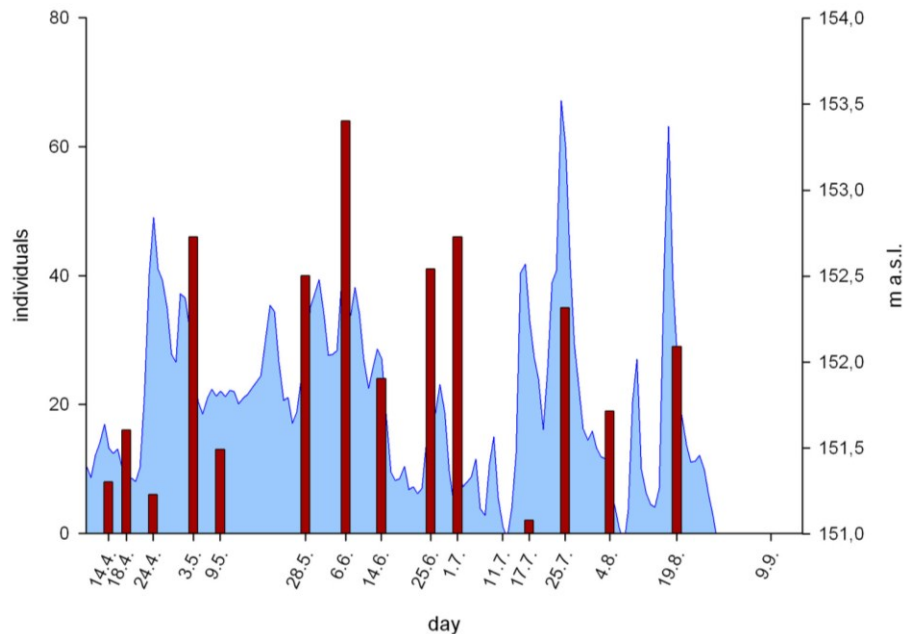


Figure 2: Captures of *Bombina bombina* (red bars: number of individuals, metamorphs not included) over the activity season in 2008 at a spawning site in Obere Lobau. Since this habitat is situated next to the river, the water level of the Danube (blue contour: meters above sea level) correlated strongly with the water levels of the spawning ponds (© D. Philippi).

Variation among years

The number of species that were recorded with comparable methods and sampling effort varied greatly among study years (Fig. 3). Note that the presence of eggs and/or larvae ("reproduction" in Fig. 3) does not always mean successful breeding. Spawning sites may dry before the larvae complete metamorphosis, floods may bring fish to formerly fish-free water bodies where they deplete amphibian larvae (detailed observations in SCHEDL et al. 2009). For several species, reproductive success was high in temporary pools that had been dry in earlier years.

Population dynamics

At a study site in Obere Lobau, 181 individuals of *Bombina bombina* were captured on 2 May 1997. At the same site, 13 individuals were encountered on 11 April and again on 21 May 2007, with two individuals present in both samples, resulting in an estimated population size of 64 (using Chapman's modification of the Petersen estimate).

At another site, only five males were heard calling in 2007 (and none captured), but in 2008, a year with a higher water table, population size was estimated as above 500, based on mark-recapture analysis of 392 individually registered toads. Beside these recapture studies on *Bombina*, the only quantitative data on populations available are spawn counts of *Rana dalmatina*.

Discussion

Habitat dynamics, especially the low predictability of water level changes in the floodplain, poses challenges for research on amphibians. Variation in habitat availability causes changes in abundance, and thus detectability of species, within (Fig. 2) as well as between years (Fig. 3). Therefore, studies must span several years to provide reliable information on distribution, habitat use and population structure. For most species, almost nothing is known about the patterns and extent of their movements in the floodplain (i.e. migrations and dispersal).

The Danube crested newt, *Triturus dobrogicus*, is a species with high conservation priority. It is included in Annex II of the Habitats Directive and listed as endangered (EN) in the Red List of Austria (GOLLMANN 2007). Our data show that it is still widespread in Lobau, but they do not suffice for estimates of population size. The large overlaps of its distribution with that of rarer species, *Pelobates fuscus* and *Rana arvalis*, suggest that *T. dobrogicus* can be regarded as an umbrella species in conservation of the amphibian community in the floodplain. Further investigations on population dynamics of this species are needed to allow assessment of its conservation status.

The fire-bellied toad, *Bombina bombina*, is also listed in Annex II of the Habitats Directive. Abundance and breeding activity are strongly influenced by water level dynamics (Fig. 2). The decline (from 1997 to 2007) observed at our first study site may have both general and local causes: Severe flooding in late summer of 2002 and the drought of 2003 probably affected many amphibian populations in Lobau. Observations of breeding success at several sites, and the widespread occurrence of subadults and adults in 2009, demonstrate that population recovery was possible. Locally, *B. bombina* and other amphibians may be impaired by the introduction of fish to a permanent water body during the flooding in 2002.

In order to increase water levels and intensify surface water exchange in Lobau, a water enhancement scheme was initiated in 2001, leading to higher water levels and reduced temporal variability in the backwater system (WEIGELHOFER et al. 2011). Whereas increased water levels are certainly beneficial for amphibians, higher connectivity of water bodies may be harmful for most species, because fish enter their breeding habitats. The high reproductive success observed in temporary water bodies suggests that habitat management allowing strong water level fluctuations may often be favourable for amphibian populations.

site	year	<i>L.vulgaris</i>	<i>T. dobrogicus</i>	<i>B. bombina</i>	<i>P. fuscus</i>	<i>H.arborea</i>	<i>B.bufo</i>	<i>R. dalmatina</i>	<i>Pelophylax</i> spp.
Hanslgrund	1996								
	1999, 2000								
	2007								
	2012								
Goethenwassser	1996								
	1999, 2000								
	2007								
	2009								
	2012								
Königsgraben	1996								
	1999, 2000								
	2009								
	2012								
Saltenstrasse	1989								
	1990								
	2012								

Figure 3: Variation of species composition at four study sites, based on at least two surveys per year (in April and June). Dark blue: reproduction, light blue: only adults found, white: no record. In 2012 the “Königsgraben” was dry (Waringer-Löschenkohl 2013). Data from the years 1996 and 1999/2000 were collected by C. Baumgartner (unpubl.). (© A. Waringer-Löschenkohl).

Conclusions

Population studies spanning several years are urgently needed to allow a profound assessment of the status of the endangered amphibian species in Lobau. In the absence of population data, the wide distributions of most species suggest that viable populations are still present. Nevertheless, long-term trends towards terrestrialization will ultimately lead to a decline in these habitats. Therefore, restoration measures sustaining overall habitat dynamics and diversity are needed but must take great care to avoid deterioration of amphibian breeding sites.

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