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Change – The transformative power of citizen science

The citizen science project "AmphiBiom": a quest to mitigate habitat loss for the European green toad

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Abstract

We aim to understand the distribution and environmental drivers for the occurrence of the European green toad (*Bufotes viridis*) in Austria and create breeding habitats for it. Citizen scientists can use a custom smartphone application (AmphiApp) to record data such as the calls of anurans and photographic documentation. The records are validated by experts. To provide breeding habitats for green toads, we gave citizen scientists 300 small plastic ponds (1.20L × 0.9W × 0.4D m) to place on their land (garden, backyard). These citizen scientists will monitor their pond every two weeks for two seasons (March–August 2024 & 2025) for the occurrence of amphibians and their invertebrate prey. During the first two months, most pond owners have been highly motivated and have followed the monitoring scheme, despite the involved procedure, likely due to our active engagement with them (e.g., during the pond delivery by team members, emails, phone calls and messaging within AmphiApp).

Keywords: AmphiApp, amphibian, aquatic invertebrates, breeding ponds, conservation, frogs, observational data, toads.

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Introduction

Amphibians are among the most threatened taxa in the animal kingdom. Global change, including habitat loss and degradation, is one of the major factors driving the ongoing decline in biodiversity. Human-made habitats can mitigate the negative impacts for some species, such as the AmphiBiom project's target species, the European green toad (*Bufotes viridis*). These toads' primary habitats (steppes and wild river floodplains; (Stöck et al. 2008) are scarce in contemporary Europe; however, toads are still found in cities and suburban areas (Landler et al. 2023; Vargová et al. 2023). Due to the projected drier weather conditions, green toads could become increasingly dependent on human-made breeding sites. Thus, anthropogenic effects in particular, such as chemical pollutants and noise pollution, could impact this species. A large study in Switzerland found that providing breeding habitats alone can be an effective conservation measure for amphibians (Moor et al. 2022). In addition, citizen science can be an effective method to monitor amphibians in an urban context and to advance conservation of this endangered animal group (Lee et al. 2021).

The aims of our AmphiBiom project are to better understand the distribution of green toads in Austria, and to identify factors that contribute to their occurrences.

Methods

We collect amphibian distribution and breeding calls data through a dedicated mobile phone application (AmphiApp) developed specifically for the AmphiBiom project. It is advertised through the project website (www.amphi.at), public outreach events (e.g., podcast), and media work (newsletter, social media). Citizen scientists record all amphibian observations including species, location, breeding calls and pictures of the habitat where they observed the individual or the animal itself. The recorded photographs and calls in the app will provide us with new information about the distribution and possibly expand the known range of the green toad and other amphibians.

Furthermore, through media outreach we solicited volunteers throughout Austria to receive and monitor a small artificial pond to place on their property (Fig. 1). Interested people applied for the ponds and we selected them based on proximity to green toad occurrences, location characteristics and tried to stratify them in the green toad range. Finally, we selected 300 localities. All of which were asked to install and use our customized phone app. The citizen scientists maintain comparable conditions throughout (e.g., no plants, sufficient water level, lack of substrate; see Fig. 1), and check their pond every two weeks in March–August, 2024 and 2025). Monitoring uses AmphiApp to record all observed amphibians and the invertebrates present in the pond. Invertebrates collected using a small provided aquarium net that is moved through the pond twice describing the figure eight, placed on a white plate, photographed, and transferred to a plastic tube filled with 70% ethanol, to be identified by experts later.

Figure 1. An artificial pond used in the AmphiBiom project (dimensions: 1.20L × 0.9W × 0.4D m), with a coconut mat that allows animals to climb out. Photograph by Lukas Landler.

Results

So far, we can only report preliminary results as data collection has just commenced. Most people who installed ponds, do take part in regular monitoring. However, close contact is required with the citizen scientists, including continuous quality control. Apart from the pond initiative, we received about 6 times more picture-based recordings than breeding calls. We notice a bias for citizen scientists to record specifically green toads versus other species, although the application provides the option to record all Austrian amphibians.

In many cases, ponds have been initially colonized by mosquito larvae, water striders and mayflies. However, backswimmer bugs and water beetles were also reported, showing the slow but steady colonization of the established ponds. Luckily, the first amphibians were also recorded, starting with the smooth newt (*Lissotriton vulgaris* during the week beginning February 26, 2024), also including common toad (*Bufo bufo*, during the week beginning March 11, 2024), water frogs (*Pelophylax* sp. during the week beginning April 1, 2024), and our target species, the green toad (Fig. 2, during the week beginning April 1, 2024).

Figure 2. A green toad recorded by an AmphiBiom citizen scientist. Photograph by Sigr/AmphiBiom CC-BY 4.0.

Discussion

Our initial results support the notion that establishing even small artificial breeding habitats can be effective in providing new habitats for amphibians and associated aquatic insects. However, to guarantee high quality scientific results, close and constant contact with citizen scientists is required to validate that they maintain comparable conditions. Despite the broadly similar conditions in the ponds, the taxa recorded so far vary. Based on the sample pictures, most ponds appear to be inhabited by water striders; while some ponds are heavily colonized by mosquito larvae, others have almost none, maybe due to the presence of predatory water insects such as backswimmer bugs. The factors that cause these differences remain to be analyzed.

Picture-based recordings might be more frequent because of the typically nocturnal calling of many anuran species, while most citizen scientists are recording predominantly during the day. One may consider approaches where people are specifically asked to go out for call surveys in the evening to overcome some of the biases. Similar to other citizen science projects, effort among the application users is highly skewed (Wood et al. 2011), with a few users recording majority of the observations.

It is already clear that even such small ponds can attract amphibians and even encourage the breeding activity. The extent to which artificial small ponds can mitigate habitat loss might be challenging to measure, but would be an important subject for future investigations.

Conclusion

Citizen science initiatives such as AmphiBiom can be vital in rapidly obtaining distribution records over extended areas, collecting ecological information, and mitigating biodiversity loss due to human induced global ecological changes.

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