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Short Note

Window traps are a potential threat for bats

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Abstract

Window traps are a common method for standardized insect sampling in forest ecosystems. Operating these traps in an oak forest, we found comparatively high numbers of bats as bycatch. This can be a serious nature conservation issue, but has not been addressed in publications so far. We operated 45 window traps randomly distributed in an oak forest in Austria for four months. The traps were made of two crossed acrylic glass windows, a top cover, and a funnel beneath the windows, directing the catch into a vessel with preservation liquid. In addition to insects, we captured 15 adult bats with these traps, i.e. approx. one bat per 13 trap months: 11 males of *Pipistrellus pygmaeus*, three males of three other species (*Myotis alcathoe*, *M. bechsteinii* and *Nyctalus noctula*) and a single female of a fifth species (*Myotis brandtii*). Bats as bycatch in an ecological survey are problematic both from legal and ecological perspective, as the species are strictly protected and as high fatalities might have a negative impact on local populations. Taken sex ratio and species composition into consideration, we assume that the bats are not caught by instance, but that the males might have tried to climb into the vessel searching for new day or mating roosts. Therefore, we recommend simple improvements to the constructive details of window traps (two simple pins or wires across the opening of the jar) to avoid bat bycatch.

Window traps are a widely used and very effective method for standardized insect sampling in forest ecosystems (e.g. Økland, 1996; Leather, 2005; Bouget et al., 2008). The most common design was invented by Wilkening et al. (1981): Two transparent, crossed acrylic glass windows act as flight barriers for insects and a container mounted beneath the windows, filled with preservation liquid, to collect the collision victims. Knuff et al. (2019) recently presented a modified and more effective type with a second collection unit on top of the windows.

Through our utilisation of window traps in an insect monitoring project, we have observed a recurring bycatch of bats (Chiroptera). This can be an important nature conservation issue, but has not been addressed in publications so far. We quantify the frequency of bat bycatch and suggest small changes in trap design to avoid this unintended mortality.

The monitoring project took place in the Leithagebirge mountains in Eastern Austria. We operated 45 window traps randomly distributed within 10 km^2 of a more or less homogenous thermophilic pannonian oak forest (Querco-Carpinetum) (Fig 1). The traps were exposed for four months (May – August 2019), mounted between the trees between 3 and 8 m above ground. The traps were made of two crossed acrylic glass windows (size 63×30 cm), with a 38 cm flowerpot coaster as top cover, and a funnel (top diameter 38 cm, bottom diameter 6 cm) beneath the windows, directing the catch into a 500 ml vessel with 70 % propylene glycol (propane-1,2-diol) as preservation liquid. The bats were identified by morphological characters (Dietz, 2016) and in the case of *Myotis* by DNA barcoding (identification of SSR markers by Microsynth Ecogenics, Switzerland).

In addition to capturing insects, our traps collected 15 adult bats, i.e. approximately one bat per 13 trap months. They were captured at 12 different traps, thus there is no evidence of spatial clustering of the bycatches. Regarding bat species composition, *Pipistrellus pygmaeus* (Leach, 1825), was the most common bat in the traps (11 specimens). Four other species (*Myotis alcathoe*, *M. bechsteinii*, *M. brandtii* and *Nyctalus noctula*) were represented by a single specimen. Nine other bat species known from the area were not caught by the traps at all. All specimens caught in traps were males except for a *Myotis bechsteinii* female.

Both from legal and ecological perspective, the comparatively high number of bats killed as bycatch might be a serious problem: As all bat species are strictly protected by the EU habitats directive and "all forms of deliberate capture or killing of specimens of these species in the wild" (Art. 12 of Council Directive 92/43/EEC of 21 May 1992) are prohibited, exceptional permissions for using these traps could be necessary[1]. Considering the small number of offspring of bats, even the loss of few females can lead to a significant weakening of the local population. On the other hand, from an ecological perspective, one could argue that the loss of few males by these traps does not seriously influence the population development.

Window traps neither attract insects nor bats and there is no increased insect density around these traps. As for explanations why bats get caught by these traps, two possibilities are conceivable: The first is visibility, as it is known that the echolocation system doesn't work well with vertical glass or other smooth surfaces (Greif et al., 2017). The second explanation focusses on the fact that eleven soprano pipistrelle males were caught: Males of this species are known to be inquisitive and regularly explore new day or mating roosts (Zahn et al., 2014; Jones and Froidevaux, 2022). Thus, we assume that bats did not overlook the traps, the opposite might be the case: they might have identified the hollow of the funnel as a possible roost, climbed into it and subsequently

[1] "For the condition as to 'deliberate' action to be met, it must be proven that the author of the act intended the capture or killing of a specimen belonging to a protected animal species or, at the very least, accepted the possibility of such": Judgment of the European Court of Justice of 18 May 2006, Commission v Spain, Case C-221/04, ECR p.4515

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Figure 1 – Window trap in oak forest.

drowned in the preservation liquid. This exploratory behaviour of pipistrelles is very common and proves also a problem with wind turbines (Zahn et al., 2014).

We recommend improvements in constructive details of window traps to avoid bat bycatch. One or two simple pins or wires across the opening of the jar (Fig. 2) might not reduce the catchability of insects, but avoid bat bycatch in these traps, as the diameter of the remaining holes is large enough for most insects to fall through, but too small for bats. Large beetles (such as some Lucanidae, Cerambycidae etc.) will also be protected from being caught. However, these taxa are usually not the target group of window traps and are often rare and protected.

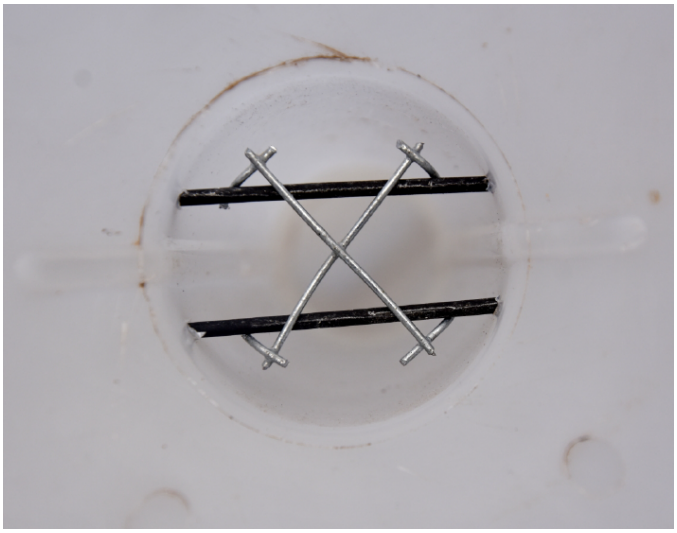

Figure 2 – Funnel bottom with two pins and a piece of hare wire to prevent bats from falling into the vessel.

Thus, avoiding bycatch of large beetles is another advantage of this improvement.

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