

What *Muscardinus avellanarius* like but consultants don't: performance of nest boxes vs. nest tubes for translocations (Rodentia: Gliridae)

Co oblíbují plšiči lískoví (*Muscardinus avellanarius*) avšak konsultanti nikoli: úspěšnost užití hnízdních budek a hnízdních rourek pro přemíst'ovací projekty (Rodentia: Gliridae)

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Abstract. Nest boxes and nest tubes are widely used for surveys, for both research and development purposes, to detect and survey hazel dormice (*Muscardinus avellanarius*). In order to compare the performance of the two devices for translocations a study was conducted where hazel dormice had the choice between nest boxes and nest tubes. Hazel dormice preferred nest tubes over nest boxes but escaped more often from nest tubes than from nest boxes during checking. We conclude that nest boxes are the better choice for translocations as they offer the better escape ratio over nest tubes.

Key words. Hazel dormouse, mitigation, handling.

INTRODUCTION

Research and monitoring of elusive animals is always difficult. This is especially true for small, nocturnal mammals that are only active during half of the year due to hibernation, such as dormice. Choosing the right methods is crucial for successful studies of such animals. In the past the invention of novel methods has always advanced our understanding about dormice and their biology. Prominent examples are the search for hazel nuts opened by hazel dormice (*Muscardinus avellanarius*) that became one of the most commonly used methods to map the distribution of this species (BRIGHT et al. 1996, 2006, BÜCHNER et al. 2009) or the setup of nest boxes (and later nest tubes) that is now the standard method to detect, investigate, monitor and/or capture dormice (MORRIS et al. 1990, JUŠKAITIS 1997, CHANIN & GUBERT 2011, WILLIAMS et al. 2013).

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Depending on the research question of a project, direct and indirect methods can be used to achieve the results required. Indirect methods such as the search for animal tracks and signs (e.g. search for opened hazel nuts or summer nests), are often less labour-intensive and can be applied to greater areas than direct methods (e.g. counting animals in nest boxes or nest tubes). For some research questions it is nevertheless necessary to use direct methods. A special circumstance using direct methods is development projects in dormouse habitats, where consultants need to assess potential impacts of the proposed development on hazel dormice and recommend appropriate mitigation measures in order to avoid the deliberate killing or injury of animals as well as habitat degradation. In general, this can be done in different ways (BRIGHT et al. 2006). When animals cannot relocate on their own, one option is to translocate them by catching and releasing them in other suitable habitats (translocation). In the course of a translocation, hazel dormice are usually captured in nest boxes, in which they are transported to a release site (recommendations in BRIGHT et al. 2006). Instead of using nest boxes, some authorities recommend nest tubes for the purpose of capturing animals to be translocated because nest tubes are easier to install, cheaper and, at least in some cases they are reported to be preferred by dormice, compared to nest boxes (M. SIMON pers. comm., but see CHANIN & GUBERT 2011).

During an ongoing development project nest boxes and nest tubes were used in equal numbers to capture hazel dormice for translocation. In order to compare the two methods, boxes and tubes were set up in a way that a comparison was possible without compromising the aim of the mitigation measure.

MATERIAL AND METHODS

The study site is part of an ongoing development project where the new highway A44 is currently under construction. This highway is a German Unification Transport Project and part of the trans-European transport network. It is for the purpose of closing gaps in the transport system between former East- and West-Germany. The section where the study took place is located in the north-east of the German federal state of Hesse (coordinates: 51° 04' N, 09° 56' E) at an altitude between 200 m and 350 m, well inside the known range of the hazel dormouse in this part of Germany (BÜCHNER et al. 2014). Since the highway leads through a corridor of high ecological value, extensive measures were taken to protect the existing fauna and flora. Part of the measures are the establishment of new information and the conservation, as well as optimization of existing habitats of the hazel dormouse. To compensate for the loss of about 38 ha of potential habitat, compensation areas for continuous ecological functionality-measures were provided.

The area affected by the development included 38 ha of potential hazel dormouse habitat (forest, forest edges and hedgerows) divided into 47 sub-sites along and adjacent to the future highway. All these sub-sites were well connected to other potential dormouse habitats. These habitats included semi-natural broad-leaved forests with European beech (*Fagus sylvatica*), common oak (*Quercus robur*) and European hornbeam (*Carpinus betulus*) as the dominating tree species, as well as conifer plantations made from Norway spruce (*Picea abies*) and Douglas fir (*Pseudotsuga menziesii*) and species rich hedgerows.

On the remaining 47 sub-sites of different size a total of 682 nest boxes and 666 nest tubes were installed. The overall density of boxes and tubes was 35.7 units/ha.

The nest boxes (size 22×9.5×9.5 cm) were made from rough-cut wood and had 25 mm diameter entrance holes facing the tree. Nest tubes (size 30×6.7×6.7 cm) were the standard model made from plastic tree guard material, with a wooden tray inside and a wooden block, sealing the tube at one end.

At 4 out of the 47 sub-sites, nest boxes and tubes were put next to each other to test whether dormice preferred one of the two devices. These sites are referred to as “comparison sites” in the text. Usually a tube was fixed on the same tree or bush as a box. If this was not possible, they were hung up as close as possible (distance <2 m). To use the same tree or bush species for both of the devices was attempted in order to avoid influence of individual habitat preferences by dormice. Altogether, 156 nest boxes and

156 nest tubes were hung up at the 4 comparison sites (11.1 ha in total). The density of boxes and tubes per hectare was 30.7, 32.6, 40.3 and 43.5, respectively.

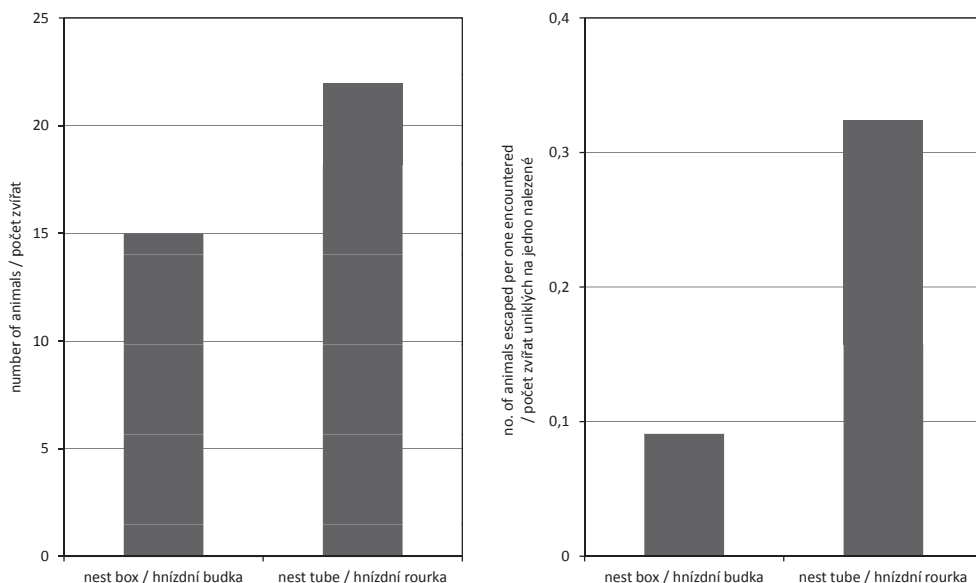
Surveys took place on 12 occasions between 10 May and 8 November 2017. During monitoring the nest boxes and nest tubes were carefully approached and entrance holes blocked to prevent animals from escaping. Every nest box and nest tube were then thoroughly checked for dormice or other inhabitants and nests. When dormice were present, the captured animals were translocated inside the box or tube respectively.

For calculations, only adult animals and independent juveniles were used because juveniles that are still dependent on their mother do not choose nesting sites by themselves.

RESULTS

Altogether 140 hazel dormice were found and 108 of them translocated; 28 animals escaped and two females with litters could not be translocated in order to avoid disturbance of their new-borns.

Apart from hazel dormice, other species including edible dormouse (*Glis glis*) (only one single animal), wood mice (*Apodemus*), bats, tits, wasps (including hornets) and ants were detected. *Apodemus* mice were the most abundant occupants of the nest boxes (288 animals) and nest tubes (68 animals).



Figs. 1, 2. Results of testings of artificial shelters for hazel dormice; left – frequency of hazel dormice encountered in nest boxes and nest tubes when given the choice; right – frequency of escaped dormice per one dormouse encountered in nest boxes and nest tubes respectively.

Obr. 1, 2. Výsledky testování umělých úkrytů plšika liskového; vlevo – četnost plšíků nalezených v hnízdních budkách a hnízdních rourkách, pakliže dostali na vybranou; vpravo – četnost uprchlých plšíků na jednoho nalezeného v hnízdních budce, respektive hnízdní rource.

At the comparison sites, 37 adult animals were found. Fifteen of these animals were inside nest boxes and 22 of the animals were inside nest tubes (Fig. 1). This suggests that animals preferred nest tubes over nest boxes and that we found 1.5 times more animals inside nest tubes.

Of the 129 adult animals encountered in nest boxes or nest tubes 28 (22%) escaped. In the tubes 23 (32%) out of 71 animals escaped and in the nest boxes 5 (9%) out of 55 animals escaped (Fig. 2). Which means animals escaped 3.6 times more often from nest tubes than from nest boxes.

DISCUSSION

Hazel dormice in our study clearly preferred nest tubes over nest boxes if both were present. These results are opposed to a study (CHANIN & GUBERT 2011) where dormice used nest boxes more frequently than nest tubes and another study, where the use of nest boxes and tubes did not differ from each other (BULLION & LOOSER in prep.).

Occupation of nest boxes by hazel dormice can be negatively affected by other species due to competition or predation (overview in JUŠKAITIS & BÜCHNER 2013 and JUŠKAITIS 2014). Small entrance holes can exclude some of the bigger competitors such as edible dormice (*Glis glis*) and less damage from racoons (*Procyon lotor*) (GATTER & SCHÜTT 1999, SCHERBAUM-HEBERER et al. 2012, BÜCHNER & LANG unpubl. data). But they fail to exclude small competitors such as yellow-necked mice (*Apodemus flavicollis*) and wood mice (*Apodemus sylvaticus*) (VERBEYLEN 2017). In our study yellow necked and wood mice preferred nest boxes over nest tubes and where found about 4 times more often in nest boxes. In the presence of competitors and especially when they reach high densities, the use of nest boxes by hazel dormice may be lower than without competitors, which has to be considered when comparing performance of our methods. The same is true for the structure and size of the boxes used. Some studies showed that hazel dormice preferred specific types and sizes of nest boxes over others (SCHERBAUM-HEBERER et al. 2012, but see discussion in VOGEL & DUPLAIN 2012, JUŠKAITIS 2014). Therefore, preference of nest tubes over nest boxes in our study may have been an effect of competition that made the nest tubes more available for hazel dormice. What we do not know is what hazel dormice would do if only nest boxes are offered, without the possibility of choosing between tubes and boxes. CHANIN & GUBERT (2011) report they had 10 out of 110 hazel dormice which were only caught in tubes and never in boxes, whereas three marked individuals were found in boxes and tubes alike. This could be due to a preference of different individuals to use either boxes or tubes and some will exclude one or the other. In our study it was not possible to prove individual preferences because every caught animal was translocated with the exception of females with very young litters (<14 days). Due to individual preferences, there might also be site-specific differences, as some studies indicate a rather higher preference for nest boxes than for tubes (CHANIN & GUBERT 2011).

Regarding capturing animals for translocation purposes, nest boxes outperformed nest tubes because fewer animals escaped from them during monitoring surveys. This is a crucial and important fact because during translocations, the objective is to capture every single individual. If escaping cannot be avoided, it will diminish the success of the translocation exercise. Nest boxes showed the same overall performance compared to nest tubes in this study if all escaped animals were considered. In summary, 48 out of 71 animals in nest tubes and 50 out of 55 animals caught in nest boxes could be translocated. It has to be taken into account that there is no valid evidence that the same animals which were caught in nest tubes could not also be caught

in nest boxes with no nest tubes nearby for them to choose. Therefore, nest boxes seem to be the better choice to capture animals for translocations (or other purposes when animals are required to be handled) as they offer the better escape ratio over nest tubes.

SOUHRN

Hnízdní budky a hnízdní rourky jsou široce využívány k mapování fauny, jak pro účely výzkumu, tak pro účely plánování hospodářského či stavebního využití krajiny, obzvláště při odhalování přítomnosti či různých typech výzkumu plšika lískového (*Muscardinus avellanarius*). Pro porovnání účelnosti obou zmíněných typů zařízení, zhusta užívaných i pro přemísťovací projekty, byla provedena studie hodnotící, jak plšící uplatňují volbu mezi oběma zařízeními a jak účelné je tedy použití hnízdních budek či hnízdních rourek. Plšící lískoví upřednostňovali hnízdní rourky před hnízdními budkami, ale při kontrolách častěji unikali z hnízdních rourek než z hnízdních budek. Výsledky testování obou zařízení tak ukazují, že pro přemísťovací projekty jsou hnízdní budky lepší volbou než hnízdní rourky, neboť nabízejí lepší poměr setrvání oproti úniku při kontrolách hnízdicích jedinců.

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