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Journal of Threatened Taxa

10.11609/jott.2023.15.1.22355-22558

www.threatenedtaxa.org

26 January 2023 (Online & Print)

15(1): 22355-22558

ISSN 0974-7907 (Online)

ISSN 0974-7893 (Print)

Open Access





ISSN 0974-7907 (Online); ISSN 0974-7893 (Print)

Publisher
Wildlife Information Liaison Development Society
www.wild.zooreach.org

Host
Zoo Outreach Organization
www.zooreach.org

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Cover: Whale Shark *Rhincodon typus* and Reef - made with poster colours. © P. Kritika.



Installation of hot boxes for conservation in the last nursery roost of Greater Horseshoe Bats *Rhinolophus ferrumequinum* in Austria

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Since the 1950s, populations of the Greater Horseshoe Bat *Rhinolophus ferrumequinum* Schreber, 1774, among several other European bat species, have plummeted, resulting in their local disappearance or even large-scale extinction (Ransome & Hutson 2000; Spitzenberger et al. 2010; Dietz & Kiefer 2014; Leitl 2021). Consequently, irrespective of its wide distribution from the western Palearctic to the east of the Asian continent and its concomitant IUCN Red List classification as Least Concern (LC), this large insectivorous bat species is nowadays considered as Endangered or even Critically Endangered in several central European countries (Piraccini 2016). Especially the loss of feeding grounds, related to agricultural intensification or change of land use, disturbances, loss of roosting sites and the loss of insects due to increased use of pesticides have been identified as factors driving population declines (Ransome & Hutson 2000; Dietz & Kiefer 2014; Matthäus et al. 2022). Nonetheless, recent studies have shown that some populations, e.g., in Great Britain are in fact stabilizing and/or recovering due to a combination of conservation efforts and perhaps also milder climate

(van der Meij et al. 2015; Froidevaux et al. 2017). Similar trends were observed in Germany's last maternity roost as well where hot boxes have been installed to provide optimal temperature conditions for Greater Horseshoe Bats (Leitl 2021) as well as for Greater Mouse-eared Bats (Dietz & Dietz 2021). According to Leitl (2021), continuous population growth was observed in the years after installation due to increased survival and higher reproductive success. Since Berthinussen et al. (2014) reported a general lack of international literature about the effects of hot boxes, only very few international (Wright et al. 2022; Zingg et al. 2022) and national (Leitl 2021; Dietz & Dietz 2021) studies became available in the meantime.

In Austria, the former distribution of *R. ferrumequinum* covered large parts of southern and eastern Austria including findings from Tyrol (Spitzenberger 2001) and Upper Austria (Pysarczuk 2008) with 16 different nursery roosts reported until 1999 (Image 1; Spitzenberger 2001). However, *R. ferrumequinum* is considered Critically Endangered by the Red List of endangered mammals of Austria

Editor: Anonymity requested.

Date of publication: 26 January 2023 (online & print)

Citation: Zangl, L., A. Gutstein, W. Paill, E. Weiss & P. Sackl (2023). Installation of hot boxes for conservation in the last nursery roost of Greater Horseshoe Bats *Rhinolophus ferrumequinum* in Austria. *Journal of Threatened Taxa* 15(1): 22548–22550. <https://doi.org/10.11609/jott.8140.15.1.22548-22550>

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Funding: Funding for the project was provided by the Austrian federal state of Styria and Agrarmarkt Austria (761A/2018/42) with support of the European Union (European Agricultural Fund for Rural Development). Additionally, Friederike Spitzenberger provided private funds for the finned tube heater. The authors furthermore acknowledge the financial support by the University of Graz for covering the Open Access Fees.

Competing interests: The authors declare no competing interests.

Acknowledgements: We like to thank Barbara Kaiser and Paul Schuster (Schloss Eggenberg) for their cooperation and granting us access to the attic. Furthermore, we kindly appreciate Friederike Spitzenberger for her support and expertise she provided us with and Rudolf Leitl for sharing his experiences.

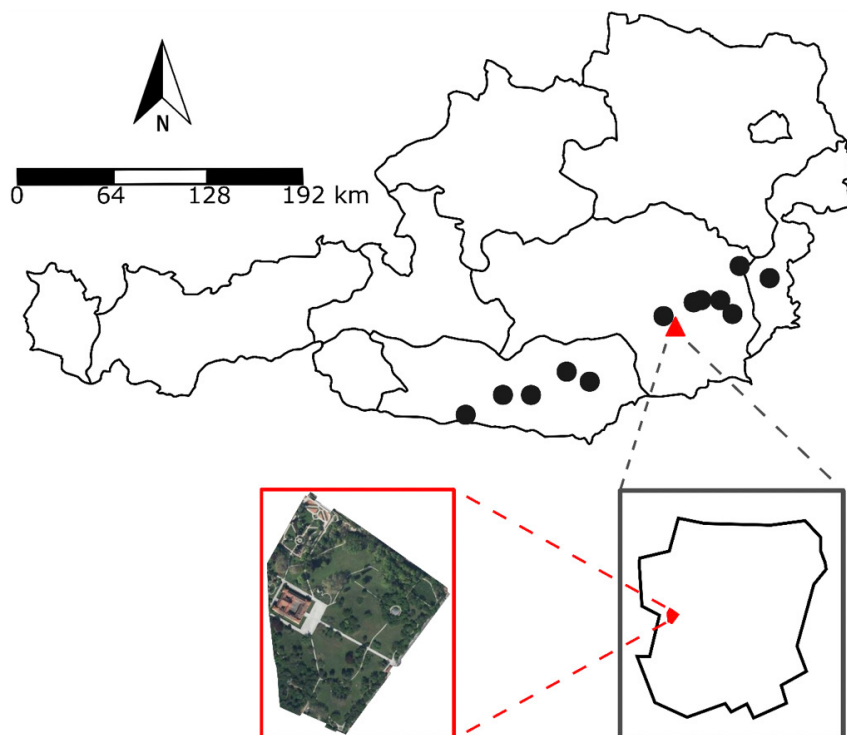


Image 1. Map of Austria (created using SimpleMappr) showing the previously known but inactive (black circles) and the last active (red triangle) maternity roosting sites of the Greater Horseshoe Bats. Inlays display the location of the SAC Schloss Eggenberg in Graz (grey frame) and a satellite image of the 17.9 ha area (red frame).

(Spitzenberger 2005) as all previously known maternity roosts have been abandoned, except the one in Schloss Eggenberg in Graz which between 2019 and 2021 harbored 48–56 female individuals (Spitzenberger et al. 2010, unpubl. data).

Consequently, following the Habitats Directive 92/43/EEC of the European Union, the castle and its surrounding gardens (Image 1 inlay) were declared as a Natura 2000 Special Area of Conservation (SAC) in 2015. Subsequently, and for the first time in Austria, in winter 2018/19, three hot boxes (one equipped with a finned tube heater (Friedrich Schultze Heizgeräte, Siegen, Germany) installed in 2021) were installed in the attic directly underneath the roof ridge of Schloss Eggenberg. The hot boxes consist of three-layered boards of wood wool with a rock wool core and measure 70 cm in height and 95 cm in diameter at the broadest section (Image 2 top left and right). The entire construction is non-flammable and equipped with wooden strips on the inside to provide proper hanging sites for the bats without damaging the covering wood wool layer. Additionally, underneath each hot box, a non-flammable box containing a webcam was installed to observe the bats' behavior and document their use of the different hot boxes. Warm spring temperatures are suggested to

help the bats maintain higher body temperatures which in turn accelerates birth dates (Ransome & McOwat 1994) and, hence, development of the young (Ransome 1973; Ransome & Hutson 2000; Dietz & Dietz 2021). Therefore, following Leitl (2021) and Dietz & Dietz (2021) we hope to improve the maternity roosting site at Schloss Eggenberg through the hot boxes and initiate a positive trend of the Austrian breeding population. Initial use of hot boxes (Image 2 bottom left and right) may indicate tentative acceptance but the overall acceptance by and effects on the breeding population will have to be determined through a long-term monitoring.

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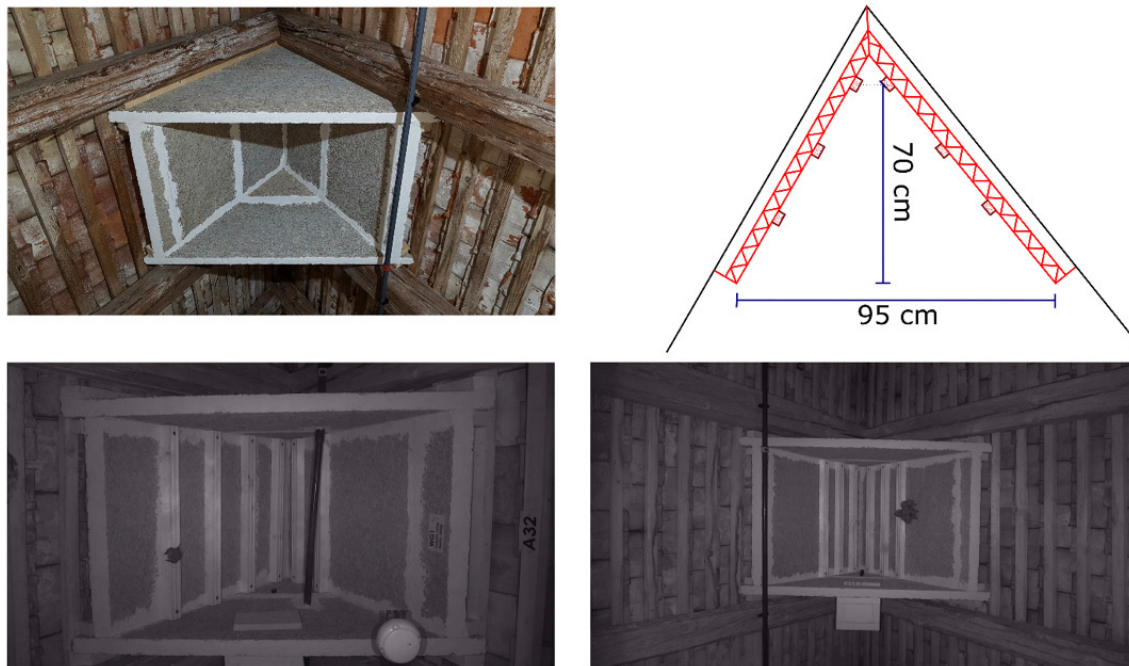


Image 2. Picture (top left) and schematics (top right) of the installed hot boxes in the attic of Schloss Eggenberg in Graz, Austria as well as webcam pictures of the first Greater Horseshoe Bats *Rhinolophus ferrumequinum* using the hot boxes (bottom left and right). Black lines in the schematics symbolize the roof, red lines indicate wood wool boards and attachments to the roof, brown squares represent wooden stripes offering hanging sites to the bats. © Picture Christian Schweiger, BT Bau-Tech GmbH.

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Print copies of the Journal are available at cost. Write to:
The Managing Editor, JoTT,
c/o Wildlife Information Liaison Development Society,
43/2 Varadarajulu Nagar, 5th Street West, Ganapathy, Coimbatore,
Tamil Nadu 641035, India
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Journal of Threatened Taxa is indexed/abstracted in Bibliography of Systematic Mycology, Biological Abstracts, BIOSIS Previews, CAB Abstracts, EBSCO, Google Scholar, Index Copernicus, Index Fungorum, JournalSeek, National Academy of Agricultural Sciences, NewJour, OCLC WorldCat, SCOPUS, Stanford University Libraries, Virtual Library of Biology, Zoological Records.

NAAS rating (India) 5.64



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ISSN 0974-7907 (Online) | ISSN 0974-7893 (Print)

January 2023 | Vol. 15 | No. 1 | Pages: 22355–22558

Date of Publication: 26 January 2023 (Online & Print)

DOI: 10.11609/jott.2023.15.1.22355-22558

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