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Comment

On greater noctule migration and dispersion: a comment to Russo et al. (2024)

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Abstract

We respond to the note by Russo et al. "Of greater noctule "migration" from Russia to Italy: a comment on Vasenkov et al. (2023)", which comments on our paper "Vasenkov DA, Vasiliev NS, Sidorchuk NV, Rozhnov VV (2023) Autumn migration of greater noctule bat (*Nyctalus lasiopterus*): through countries and over mountains to a new migration flight record in bats. Dokl Biol Sci 513:395–399. https://doi.org/10.1134/S0012496623700746" regarding our use of the term "migration". We used "migration" to describe the long-distance seasonal flights of three greater noctule (*Nyctalus lasiopterus*) individuals. We chose exactly this term as it is commonly used in a broader sense to refer to bat autumn long-distance flights, when the further fate of these flying bats remains unknown. Russo and co-authors challenge the use of the term "migration" in the context of bat long-distance movements. However, we believe that it is not always easy to efficiently distinguish between cases of dispersal flight and migratory flight.

Keywords Bats · GPS-GSM tracker · Migration · *Nyctalus*

In their "point of view", Russo et al. (2024) challenge our use of the term "migration", which we used to describe the long-distance seasonal flights of three greater noctule (*Nyctalus lasiopterus*) individuals (Vasenkov et al. 2023). All three individuals made long-distance flights from their summer habitats in Russia to other European countries in late September and early October. The departure points of all three greater noctule bats were in the Meshchera National Park, but their flights in the south-western direction ran along different routes. We used prototype GPS-GSM trackers to record the movement of the bats and in doing so, we could not predict how long these would work. The trackers had varying operating times and stopped data transmission in different countries (Poland, Bulgaria and Italy). Thus, obviously, we cannot claim that we tracked the long-distance flights of the tagged bats to their final destination.

Unfortunately, there is no clear "correct" answer to the remark of Russo et al. (2024) claiming the incorrect use of the term "migration" with respect to the individual male in question, because we do not know the further fate of this male. Its tracker stopped signal transmission due to battery death in northwestern Italy, near the border to France. The male's fate could be very diverse. On the one hand, it might have stayed for the winter in Italy, or maybe even went further west, to France or even to Spain, and might have continued living in the wintering area during the summer (Ibáñez and Juste 2023). In such case, its flight to Italy could be called a dispersion. But another option is also possible. This male could have returned to the east after wintering. In countries east of Italy, adult males were found in summer outside the migration period, such as in Slovenia (Zidar 2020; Gojznikar 2021), Hungary (Estók 2007) and even in southern Russia and Georgia (Tsytsulina 1998). Overall, information about the greater noctule biology outside Spain is very scarce (Ibáñez and Juste 2023). Therefore, it is difficult to predict whether males of this species remain directly near the wintering grounds in summer or move farther away from them, including in the direction of their place of birth.

If we consider the terminology, then it is easy to separate "dispersion" and "migration" of bats, at least in extreme cases (Moussy et al. 2013). Considering the former

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("dispersion"), the bat would fly far from its birth place to the wintering place, spending its entire subsequent life near the wintering place. In the latter case ("migration"), the bat would return every year exactly to its place of birth. But these are extreme cases along a gradient of possibilities, which animals from natural population are frequently found to adopt. This is shown by observations of migrating bat species (Hutterer et al. 2005; Moussy et al. 2013; Lehnert et al. 2018; Kruszynski et al. 2020). Therefore, it is not always easy to clearly distinguish whether an animal has made a dispersal flight or migratory flight. If a bat flies 2500 km from its birth place to its wintering place in autumn, and returns 500 km in the opposite direction in summer, is this "dispersion" or "migration"? And what if it returns for 1000, 1500, or 2000 km? Where do we draw the line?

In any case, in order to clearly classify the young bat's autumn movement into the categories of "dispersion" or "migration", it is necessary to know its further fate. In our case, we did not know our young greater noctule's male fate after its GPS tracker was discharged and stopped transmitting information about its movements (Vasenkov et al. 2023). Therefore, we used the term "migration" in a broader sense, as it is commonly and widely used by colleagues in this field of research when referring to bat autumn long-distance flights (e.g., Alcalde et al. 2021; Bach et al. 2022), in particular when the further fate of the individual in question is unknown (e.g., Furmankiewicz and Kucharska 2009; Rydell et al. 2014; Ancillotto and Russo 2015; Bartonicka et al. 2019; Ciechanowski et al. 2016; Widerin and Reiter 2019; Caprio et al. 2020; True et al. 2023). In our opinion, the use of this term in such context is justified. At least so far, there is no alternative term for this behavior of seasonal bat movements over long distances, i.e., for cases when it remains unknown whether individuals flying away in autumn will return (or how close they will approach) towards their birthplaces in spring.

We agree that the issue addressed by Russo and co-authors (2024) regarding the use of a proper terminology towards long-distance movements of bats is an important topic to consider and to discuss. Perhaps new insights into bat long-distance movements due to the emergence of new technical means (GPS, radio trackers: Nad'o et al. 2019; Bach et al. 2022; True et al. 2023) will require the development of a new bat movement classification, previously all united under the term "migration". We propose that, for example, a differentiation is justified by differences in speed/intensity of bats' long-distance (> 1000 km) seasonal movements. "Fast" migration typically occurs in migratory bat species of temperate latitudes, which fly from summer breeding sites to wintering sites within a short time (2–4 weeks) (Hutterer et al. 2005; Vasenkov et al. 2023). "Slow" migration is characterized by a more extended movement period (more than 1.5–2 months, up to six months) and has been observed in migrating bats of subtropical and tropical latitudes, in particular in some species of fruit bats (Richter and Cumming 2008; Fleming 2019). "Fast" migration is characterized by a very tense energy balance in individuals, the study of which has been intensively developed in recent years (Currie et al. 2023). "Slow" migration can be very long in distance, and it can reach 2000 km or even more in six months (Richter and Cumming 2008; Welbergen et al. 2020). Moreover, the average speed of such movements can be very small, 10–90 km/day (ibid.). In contrast, "fast" migration occurs more intensely, with an average speed of up to 150–200 km/day (Vasenkov et al. 2023). Thus, in this sense, we agree that the question of the limits of the term "migration", as raised by Russo and co-authors, is justified, as this topic needs to be developed further. In the future, we can expect a strong and considerable increase of individual-based data on bat movements due to the miniaturization of trackers and its increasing availability to researchers. This, of course, will require new and adequate classifications of such an expected pile of information on bat long-distance movements, which can currently be characterized by the term "migration". As for the greater noctule bats from the Meshchera National Park population that we have been studying since 2017, it is possible to unambiguously answer the question of the migration status of males only by increasing the number of autumn long-distance flight tracks or on the basis of genetic studies.

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Declaration

Conflict of interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

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