Satellite tracking of White’s Thrushes Zoothera aurea from the Ural Mountains, Russia, to central Mongolia

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Abstract

Little is known on the migration routes of songbirds breeding in Siberia. We used satellite transmitters to study the migration of two White’s Thrushes Zoothera aurea captured during breeding season in the Ural Mountains, Russia. One of the devices transmitted during spring and the breeding season (May to September) in the following year from the Khangai Mountains of central Mongolia, 3000 km southeast of its former breeding season site. Based on the combination of lack of accurate locations, potentially unsuitable habitat, unusual behaviour, and unusual location outside of the known breeding range we consider it most likely that the bird died there during migration, while the transmitter continued to function. No data on migration routes or non-breeding areas were received, although the movement to Mongolia suggest a migration route east of the Qinghai-Tibetan plateau.

Introduction

The White’s Thrush Zoothera aurea has a wide breeding distribution in the taiga forest zone between the Ural Mountains in the west and Sakhalin Island in the east. Only little is known about the species’ ecology, migration routes and non-breeding range. Birds are known to breed between May and July and to depart from their breeding sites in August and September. During the boreal winter, White’s Thrushes have been observed in southern Japan, the Philippines, in southern China, Southeast Asia and India. During migration, this species is not only found in forests but sometimes also uses more open habitats. However, many of the observations during the non-breeding season are doubtful, as the complicated and not fully resolved taxonomy of Zoothera species renders field identification of these shy birds difficult, especially away from the breeding grounds. Many hundred White’s Thrushes were marked with metal rings since the 1960s in Russia and Japan, but no long-distance recoveries have been obtained so far, I. Panov in litt.). The global population of the White’s Thrush is considered to be declining, with ongoing deforestation as a potential threat. Furthermore, unsustainable hunting during the non-breeding season might limit its population, as has been suggested for many East Asian landbirds. The aim of our study was to discern migration routes and non-breeding areas of the westernmost breeding population of this little-studied species using satellite telemetry.

Material and methods

We searched for singing White’s Thrushes between dusk and dawn 19 to 26 June 2019 downslope the Kvarkush ridge, Ural Mountains, Russia (58.79°E, 60.14°N). Once we located a singing male, we tried to capture it with mist-nets and playback of the species’ song. The two trapped birds were ringed with a metal ring from the Moscow Bird Ringing Centre and equipped with Platform Terminal Transmitters (PTTs) (5 g solar PTT-100, Microwave Telemetry Inc., Maryland, USA), which corresponded to 3.5-3.6% of their
body weight (145 and 138g). For the first bird, an adult male of unknown age, we used a full body harness (including loops around the neck and the wings) out of 2 mm braded nylon strings to fit the tag (ID: 84240). For the second bird, a second-year male, we used a leg-loop harness made of flexible string to fit the PTT (ID: 84238).

Location estimates were obtained from PTTs by interpreting the Doppler effect of transmissions from the tags to the Argos Satellite system. Position quality and accuracy is determined by the number and duration of transmissions, e.g. location class 3 = <250 m accuracy, [?]4 transmissions; 2 = 250-500 m accuracy, [?]4 transmissions; 1 = 500-1500 m accuracy, [?]4 transmissions; 0 = >1500m, [?]4 transmissions; A = accuracy not provided, 3 transmissions; B = accuracy not provided, 1 or 2 transmissions; Z = invalid location (https://www.argos-system.org/wp-content/uploads/2023/01/CLS-Argos-System-User-Manual.pdf). Fixes of location class A can have a precision of 15 km, and of location class B of 56 km for latitude and 94 km for longitude, while another study from Russia found a precision of 2.1 and 18.3 km for classes A and B, respectively. The tags had a solar cell and the temporal schedule was 10 hours transmission followed by 48 hours off.

The transmitters were equipped with additional sensors that stored battery voltage, temperature, and activity (i.e. whether there has been movement between subsequent transmissions, where 0 = no movement). Such data can help to ascertain whether a tracked individual has died, or whether the tag has failed. The death of an animal or loss of transmitter may be signalled by 1) sudden changes in battery charge that indicate that the tag is lying upside down (being unable to charge) or by sudden increases in battery voltage that suggest the placement of the tag at a stationary, exposed site or 2) sudden loss of contact despite preceding good transmissions and/or battery performance, 3) temperature values that suddenly change or follow the environmental conditions (not buffered by body temperature of live animal). Furthermore, we apply the classification developed by Sergio et al. (2019) to determine deaths: a bird would be classified as dead if 4) the value of the activity counter would be stable or 5) if the value of the activity counter would not be stable but <50% of the positions would belong to location classes 2 and 3. We tested for differences in the measurements of these additional sensors between the locations by performing Wilcoxon rank sum tests using the stats package in R version 4.3.1.

Results

For individual tagged with transmitter number 84238, we received 5 positions between 27 June and 8 July 2019 from the site of tagging (mean coordinates: 58.868degE, 60.170degN). For individual 84240, we received 45 positions between 22 June and 24 July 2019 from the Ural Mountains. This bird stayed close to the site of tagging until 24 June 2019 (mean coordinates: 58.653degE, 60.136degN), and then moved 75 km southward (mean coordinates: 58.525degE, 59.459degN), from where it transmitted between 26 June to 24 July 2019. During the non-breeding season, only a single transmission of location class Z (invalid location) was received. Between 17 May and 27 September 2020, we received locations from the Khangai Mountains near Jargalant, Bayankhongor province, central Mongolia (mean coordinates: 99.007degE, 46.802degN), 2989 km southeast from the site of tagging (Figure 1).
Figure 1: Breeding season locations of satellite-tracked White’s Thrushes in the Ural Mountains, Russia (top left) and in central Mongolia (top right). The red dashed line connects the two areas at great circle distance, which could be a possible migration route. Note that only one individual (84240) transmitted from Mongolia. Location classes are determined by the number of transmissions and differ in accuracy: location class 1 = 500-1500 m accuracy, [?]4 transmissions; 0 = >1500m accuracy, [?]4 transmissions; A = 3 transmissions and B = 1 or 2 transmissions, the two last with unknown accuracy. Photo: White’s Thrush with satellite transmitter by Anna Korshunova. Breeding and non-breeding range after BirdLife International (2022). Source of the background satellite images: OpenStreetMap.

We found no difference in mean activity scores between the positions of individual 84240 from the Ural Mountains and those transmitted from Mongolia (W = 2379, p = 0.85), but higher mean battery voltage in Mongolia (W = 1519, p < 0.01). Mean temperature did not differ between positions from the Ural Mountains and from Mongolia (W = 2734, p = 0.31). We also observed no obvious changes in activity score, battery voltage or temperature neither during the time in the Ural Mountains nor in Mongolia that would hint at mortality (Figure 2). Transmitted positions from the Ural Mountains included location classes of higher
quality and accuracy (6% 1, 9% 0, 18% A, 56% B, 12% Z) compared to locations transmitted from Mongolia (26% A, 75% B).

Discussion

Our study provides the first satellite-tracking data of a songbird species from Siberia. We detected a long-distance movement of a White’s Thrush from its breeding grounds in western Russia to a site in central Mongolia (Figure 1). Recent ringing activities have confirmed the regular occurrence of White’s Thrushes during migration both in eastern and north-western Mongolia (Davaasuren et al. 2021, 2023). Based on the movement through Mongolia, a migration route of the White’s Thrush east of the Qinghai-Tibetan plateau seems most likely. Little is known on the migration routes of songbirds breeding in Siberia. A recent tracking study demonstrated that Arctic Warblers Phylloscopus borealis migrating from Central Siberia to South-East Asia migrate initially eastward during autumn migration and use spring stopover sites in central Mongolia as well. We can only speculate that a similar route may be used by White’s Thrushes.

During breeding season in the Ural Mountains, one individual changed its territory by around 75 km. This could either signify a breeding site change by an unpaired male or after the loss of the brood, or the movement might be linked to seasonal changes in resource availability that might be typical for mountainous habitats. But we can also not rule out the possibility that this was evasive behaviour caused by the capture of the bird, as the tagging with tracking devices can affect site fidelity of breeding birds.

We determined that the tracked White’s Thrush was likely dead during its long stay between May and September in Mongolia following the classification by Sergio et al. (2019) based on unstable activity values but a proportion of <50% of location classes 2 and 3 (0% in our data). This is fortified by the observation that most of the transmitted positions are centred around an area of unsuitable, barren desert (Figure 1). While the location quality of all transmitted positions from Mongolia is very low (only A or B) with unknown accuracy, the clustering of positions suggests that the locations are realistic in a range of few kilometres. When comparing the patterns between the Ural Mountains and Mongolia, it is evident that positions of location class B seem to have a larger longitudinal error, while the latitudinal error seems to be negligible (Figure 1), as has been found in other studies well. The mean battery voltage was significantly higher in Mongolia compared to the Ural Mountains (Figure 2), which might be also explained by a more open habitat (atypical for the species) that facilitated solar recharge. On top of that, a breeding site change of 3000 km

Figure 2: Measurements of additional sensors of a tracked White’s Thrush while transmitting from the Ural Mountains, Russia, and central Mongolia between June 2019 and November 2020. The colour of the dots corresponds to the location classes in Figure 1.
would be unusual behaviour for a songbird, especially since the positions are located outside of the known breeding range. Most bird species are considered to show a high level of breeding site fidelity, as indicated by high apparent survival rates. However, breeding site changes of up to 7,500 km are documented for waterbirds and shorebirds.

Based on the combination of 1) lack of accurate locations, 2) potentially unsuitable habitat at the centre of the coordinates (barren desert), 3) increased battery voltage that also hint at atypical habitat, 4) unusual behaviour (3000 km breeding site change) and 5) unusual location (south of the known breeding range) we consider it most likely that the bird died there during migration and the tag continued to transmit until snow covered it in October.

However, we cannot determine the exact time of death, and it is possible that the bird was alive during the first days or weeks in Mongolia and might have set up a territory in the area. While the stationary site of the tracked White’s Thrush in Mongolia lies south of the known breeding distribution of the species, recent breeding season records in the western Altai Mountains as well as in Kyrgyzstan, 2000 km south of the main breeding distribution (Van Els & Hiddes 2022), clearly demonstrate that this species is easily overlooked. In the Ural Mountains, we captured the bird in montane spruce forest just below the tree line at around 500 m asl. In Mongolia, positions were estimated to come from 1900-2400 m asl in the Khangai Mountains, where northern slopes are covered with coniferous forests close to the tree line. However, such possible breeding habitat can only be found ca. 60 km north of the actual positions.

Both transmitters failed to transmit any valid positions during the non-breeding season and fell silent after July in the first year of tracking, when both individuals were still in the breeding area. We consider it unlikely that the birds already left the breeding area in July, as White’s Thrushes have been observed in the Ural Mountains as late as mid-September. More likely, the transmissions ended when the birds started their post-breeding moult. During breeding season, males are singing from the top of high trees, which likely allowed battery charging and data transmission. But during the non-breeding season, and especially so during moult, White’s Thrushes behave very secretively and are usually found close to the ground under dense vegetation, where the solar panel might not have gotten enough light to recharge the battery, or the antenna might not have been able to establish contact with satellites.

Future tracking studies should test whether devices with a larger battery not dependent on solar charging would provide more information on the still unknown non-breeding distribution of this enigmatic species.

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Data availability

Tracking data from this study are publicly available at Movebank (www.movebank.org) in the study “White’s Thrush (Zoothera aurea) Russia” (Movebank study ID 802888781).

References


Beauchamp G (2022) Colonial breeding birds show greater annual adult apparent survival globally. Ibis 164:711–718

BirdLife International (2022) Species factsheet: Zoothera aurea


Heim W, Bourski O, Schemelева K, et al (2023) From Siberia to Indonesia: tracking the migration of the Arctic Warbler Phylloscopus borealis


Kempenaers B, Valcu M (2017) Breeding site sampling across the Arctic by individual males of a polygynous shorebird. Nature 541:528–531


