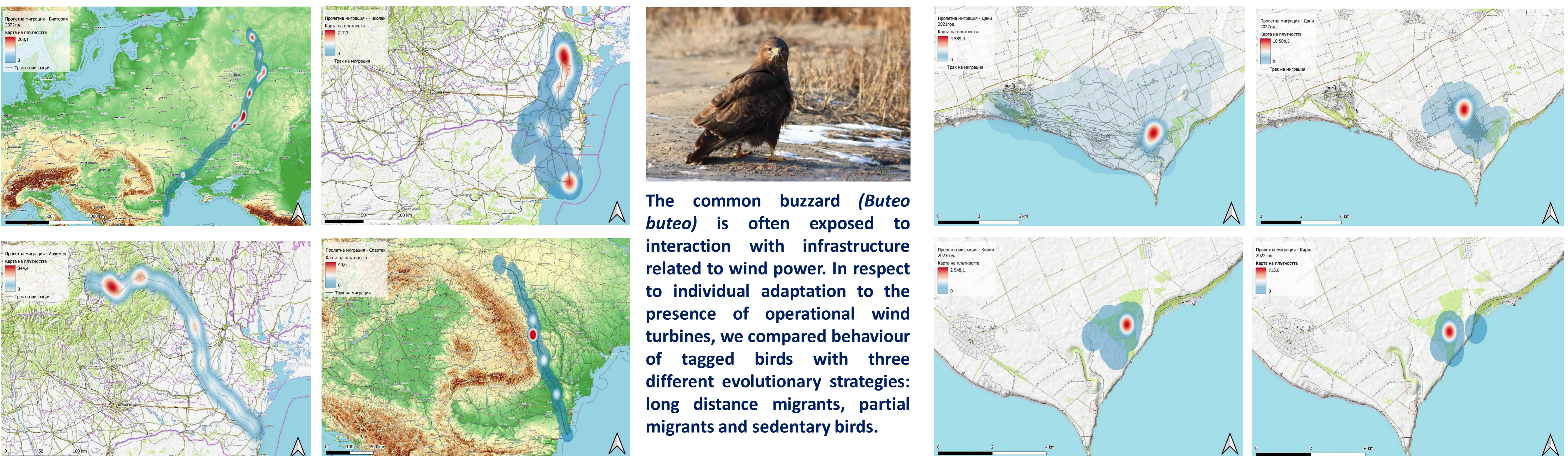


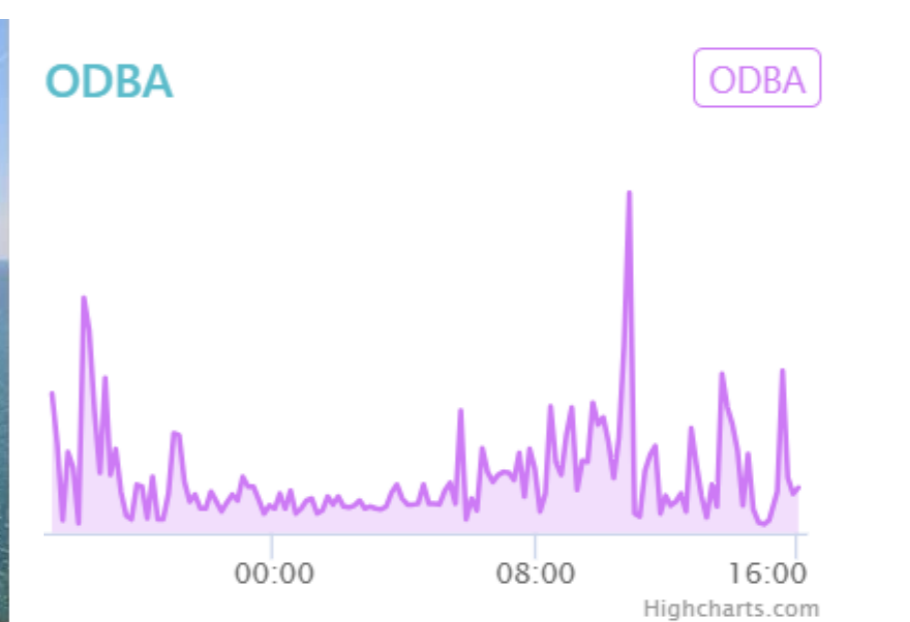
## The Idea: GPS tracking of potential changes in behavior in respect to wind turbines



The common buzzard (*Buteo buteo*) is often exposed to interaction with infrastructure related to wind power. In respect to individual adaptation to the presence of operational wind turbines, we compared behaviour of tagged birds with three different evolutionary strategies: long distance migrants, partial migrants and sedentary birds.

## Methods: GPS/GSM tracking and GIS analysis

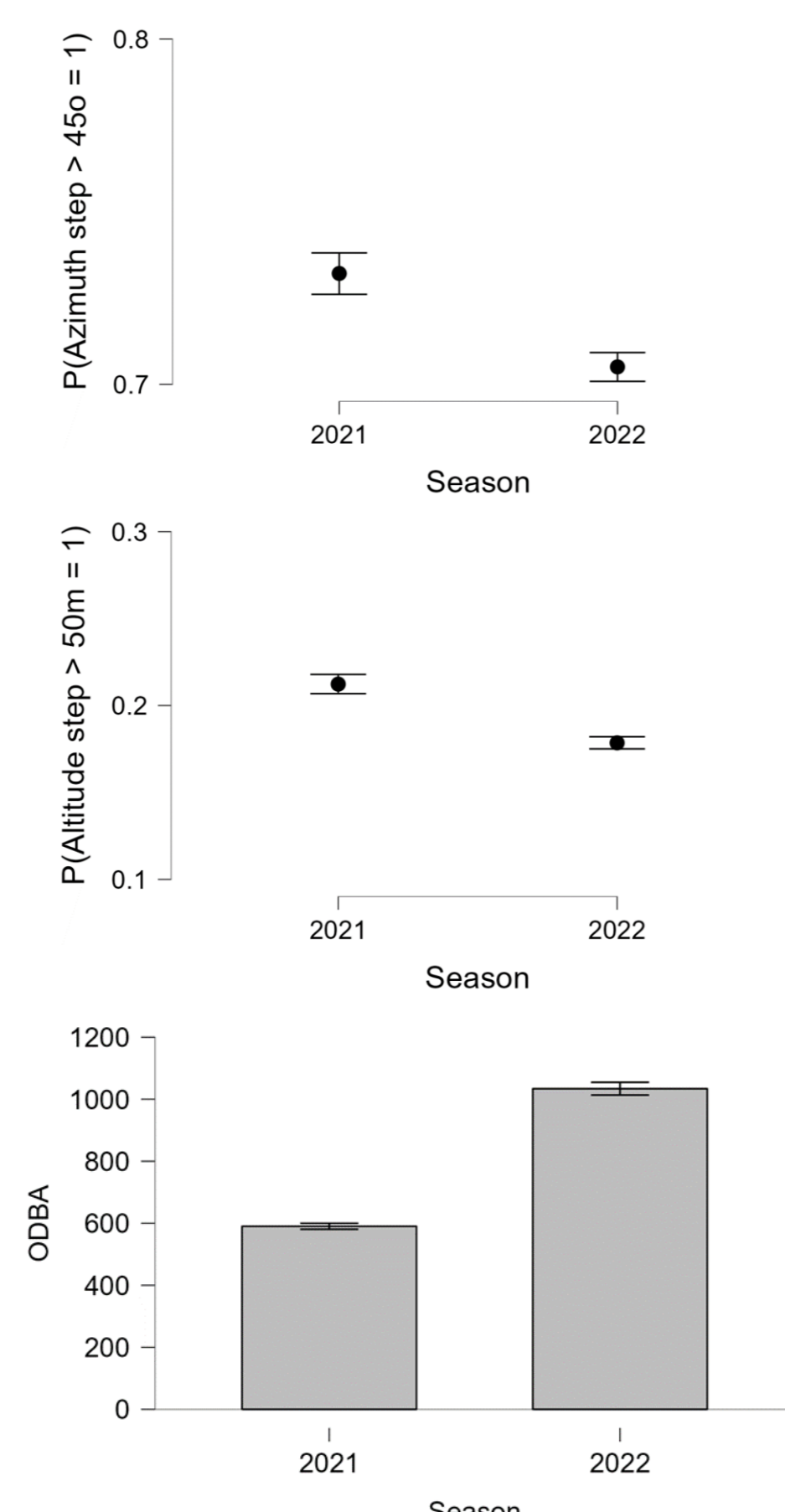
In last three years (2021-2023) we tagged 8 common buzzards with GPS/GSM transmitters in order to evaluate flight activity of the birds and the potential mortality rate in an area with operational 114 wind turbines. We measured several variables of flight activity, indicating bird response to the presence of wind turbines: changes in flight direction with more than 45°, changes in altitude of flight with more than 50m, and Overall Dynamic Body Acceleration (an acceleration index which quantifies the three-dimensional movement of birds as the value of acceleration, ODBA). We selected overlapping periods of time in two consecutive years for 2 individuals (Dani and Kiril) to compare within-individual variation, and an overlapping period of time for 4 individuals to compare among-individual variation in flight activity. For the two individuals, we used logistic regression in order to test if each presence/absence of change in altitude or direction with more than 50 m or 45°, respectively, can be predicted by the season. To compare within- and between individual differences in ODBA, we used Mann-Whitney U test and Kruskal-Wallis Test, respectively. The data was analyzed with QGIS and JASP 0.17.



## Results: comparative analysis

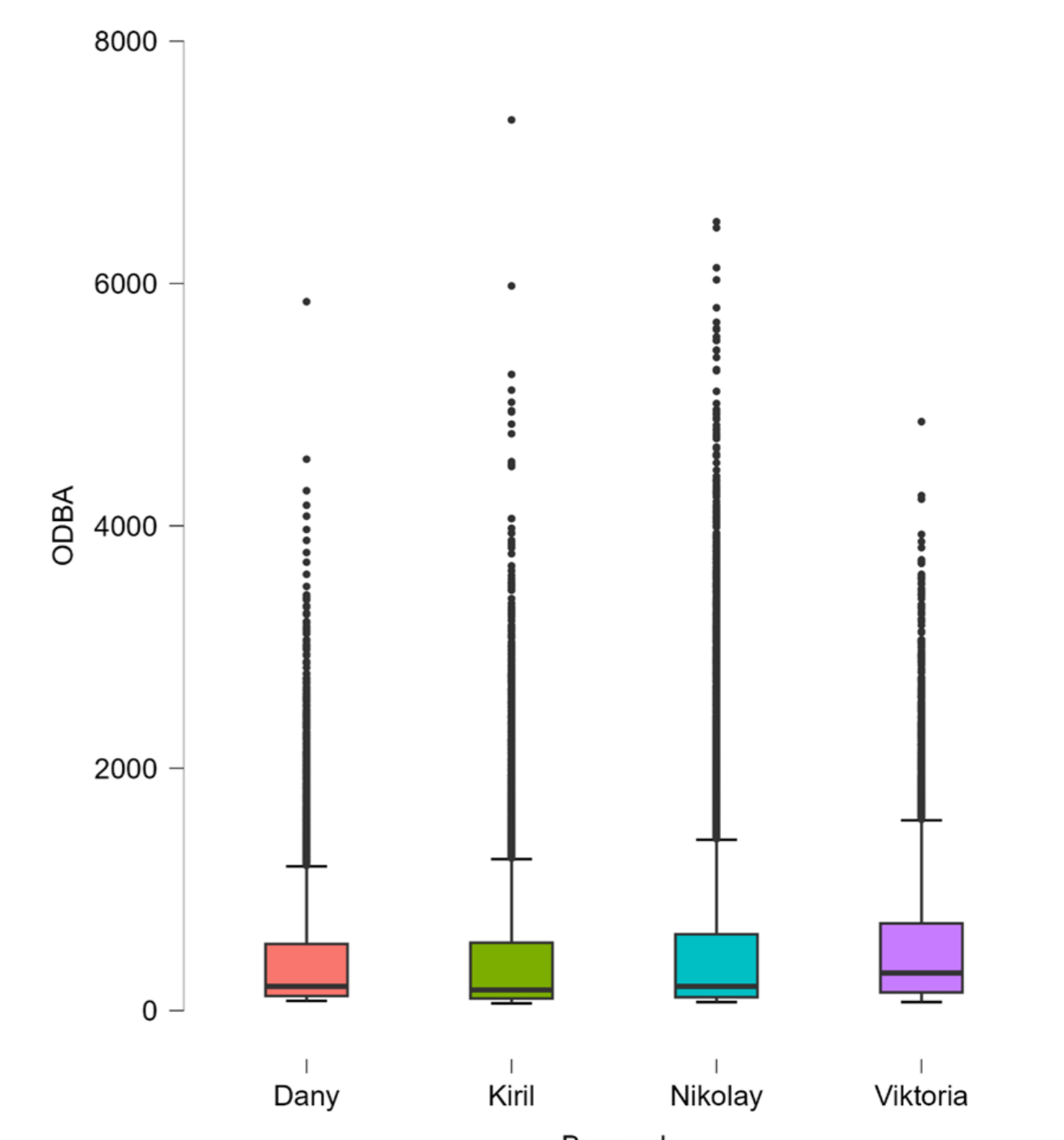
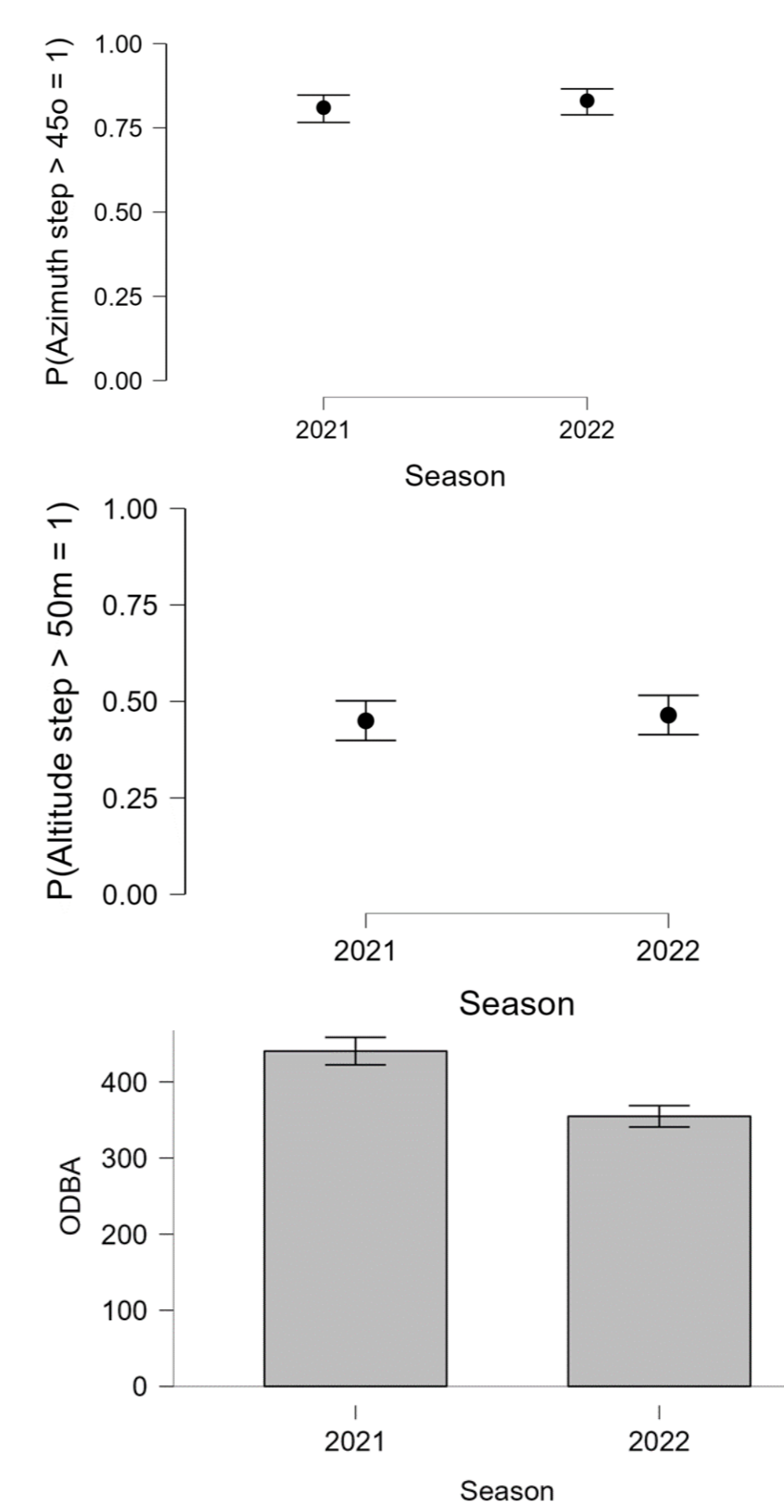
Our results show that all tagged free-living common buzzards has experienced contacts with operational wind turbines. Over 200 fixes were located in radius of 20 m around a wind turbine. Over 2285 fixes were located in radius of 100 m around a wind turbine and 53 400 fixes were located in radius of 500 m around a wind turbine. None of the tagged birds died in collision with wind turbines, 3 were poisoned by rodent pesticides, one was shot by poachers.

A comparison of changes in flight direction with more than 45°, changes in altitude of flight with more than 50 m, and overall dynamic acceleration of the body of Dani in two consecutive seasons (2021 and 2022).



For the first individual (Dani), who nested far from wind turbines during the breeding season 2021, and in a shelterbelt between two operational turbines in 2022, we expected higher rate of flight changes in altitude and direction, and lower ODBA in 2022. Contrary, the results were exactly the opposite (left). For the second individual (Kiril), who occupied the same area in both seasons, no significant difference in the changes of flight altitude and direction between the seasons was found, as we expected. However, his ODBA was higher in 2021 (right).

A comparison of changes in flight direction with more than 45°, changes in altitude of flight with more than 50 m, and overall dynamic acceleration of the body of Kiril in two consecutive seasons (2021 and 2022).



There was a significant difference among individual buzzards in respect to overall dynamic acceleration of the body for the same time period, with the highest value for Nikolay, followed by Viktoria, then Kiril, and finally – Dani.

**CONCLUSIONS:** The Common buzzard, a model bird species, demonstrated within and between individual differences in migratory strategy and flight activity, measured as number of changes in flight altitude, flight direction and ODBA. Our results, however, did not confirm any relationship of the birds' flight activity to the presence of operational wind turbines, and no clear avoidance behaviour of birds while flying among turbines in their breeding range was found. On this basis, we can conclude that the wind turbines do not constitute material obstacle for normal life of the common buzzards.