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Letter to the editor

Toward integrating migration counts and GPS tracking for flyway-scale avian population monitoring — A response to Efrat et al. (2025)

For over half a century, migration counts offered an effective way to monitor and assess large-scale population trends for migratory raptors whose low-density populations are otherwise hard to survey. The basic assumption underlying the utility of migration counts as a population monitoring tool is that consistent proportions of source populations migrate past a given watch-site each year. Historically, it was nigh impossible to validate this assumption directly. Instead, inferences about population changes were mostly made for species with relatively low year-to-year fluctuations in numbers. With the recent advent of GPS-tracking, however, it was realized early on that remote tracking could help verify the assumptions underlying migration-based monitoring efforts.

In their recent contribution, Efrat et al. (2025); Biological Conservation, 302: 110959) made the most comprehensive effort to date, leveraging large GPS tracking datasets to validate the monitoring potential of migration counts at two well-established watch-sites in the East African-Eurasian flyway: Eilat, Israel, and Batumi, Republic of Georgia. We strongly support using tracking data to critically evaluate monitoring efforts, in line with recommendations by Jobson et al. (2021), to develop an effective flyway-scale monitoring network in this understudied and underfunded flyway. Nevertheless, the study by Efrat et al. (2025) comes with important caveats in its interpretation of the monitoring potential of watch-sites and leaves several key opportunities for the integration of count and tracking efforts underexplored.

Understanding which populations are represented in migration counts is crucial for conservation, as it helps pinpoint those (non-) breeding areas where environmental changes may drive trends observed at migration watch-sites. Efrat et al. (2025) use the probability of observing a tracked bird to evaluate how informative the Eilat and Batumi sites are for Steppe Eagle and Black Kite, respectively. However, considering that individuals from distinct (non)breeding areas may migrate through the same bottlenecks in different proportions, the observed counts and trends likely reflect the dynamics of these different populations, complicating interpretations. Since Efrat et al. (2025) use tracking datasets heavily biased toward particular breeding (Steppe Eagle) and nonbreeding (Black Kite) populations, conclusions about the proportion and consistency of populations passing these sites remain limited to the tracked populations and should not be generalized to the overall monitoring potential.

This problem of generalization is illustrated by the fact that standardized surveys at both Eilat and Batumi capture a substantial portion of the flyway and even global populations of certain species, as evidenced by the sheer volume of migrating raptors observed (Shirihai et al., 2000; Vansteelant et al., 2020; Verhelst et al., 2011). Although GPS tracking has revealed the geographical origin of some raptors observed at Batumi (Zaytseva et al., 2022), tracking data for most species remains insufficient to quantify connectivity between bottleneck sites and (non-)breeding regions (Jobson et al., 2021).

Fortunately, Efrat et al. (2025) offer hope for resolving this limitation by demonstrating that large tracking datasets can clarify the population-level origins and destinations of birds counted at key watch-sites. Building on this, we see great potential in using sustained tracking data to overcome the longstanding assumption of 'consistent route choice', enabling retrospective and prospective assignment of counted individuals to regional populations. Coupled with spatially-explicit movement modelling, this opens new possibilities for population-specific trend analyses that account for variation in routes, weather, and timing. Even when tracking efforts are limited to specific populations, such data can reveal intra-seasonal phenological patterns in migration to help infer population-level dynamics in count data, e.g., if early-arriving individuals originate from one region, their trend could be separated from that of later migrants. At the same time, migration counts can enrich the interpretation of tracking data by placing individual movements in a broader ecological context — including species associations, social dynamics, and relative abundances — that is often missing from individual tracks.

Above all, migration counts offer a multifaceted form of long-term scientific ecological monitoring. They are relatively inexpensive, non-invasive, and supported by a long tradition of global volunteer involvement. Furthermore, migration counts contribute more broadly to conservation by fostering public engagement, local and flyway-scale capacity building, supporting environmental education, and sustaining local economies through ecotourism (Hoekstra et al., 2020). While these social dimensions are essential for long-term conservation impact, we recognize that projects dependent on international 'voluntourism' pose challenges in terms of inclusivity and accessibility, and carry substantial carbon footprints. Minimizing these drawbacks by investing in salaried positions for local observers, reducing air travel, and offsetting inevitable emissions helps ensure that migration monitoring remains aligned with global sustainability goals.

Realizing the conservation potential of migration counts will require coordinated data sharing and long-term investment in both tracking and migration count efforts. Crucially, many of the broader conservation goals associated with both tracking and migration monitoring — including identifying region-specific drivers of population change and informing targeted action — hinge on the widespread availability, openness and integration of both types of data. Migration counts in an era of individual tracking remain a powerful and sustainable monitoring tool, one whose value will only grow as we begin to systematically connect them to breeding and non-breeding populations through tracking.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

No data was used for the research described in the article.

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Bart Hoekstra[a,b,*], Wouter Vansteelant[a,b,c], Dries Engelen[a], Tohar Tal[a,b]

[a] *Batumi Raptor Count, Almere, the Netherlands*

[b] *Institute for Biodiversity and Ecosystem Dynamics, University of Amsterdam, Amsterdam, the Netherlands*

[c] *BirdEyes Centre for Global Ecological Change, University of Groningen, Leeuwarden, the Netherlands*

[*] Corresponding author at: Batumi Raptor Count, Hannah Arendtweg 84, 1349CM Almere, the Netherlands.

E-mail address: bart.hoekstra@batumiraptorcount.org (B. Hoekstra).