ABSTRACT

for the PhD dissertation in the educational program "8D05101 – Biology" by

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"Features of breeding biology and seasonal migrations of Aves, Columbiformes of South and South-East Kazakhstan"

General description

The study investigates nesting biology and migration of Columbiformes in Southern and South-Eastern Kazakhstan, covering species composition, distribution, breeding ecology, seasonal movements, morphometrics, and population status. The work is based on field observations and satellite tracking (2020-2024) and long-term ringing and count data from 1966-2023.

Research relevance

Columbiformes are widely distributed across Kazakhstan, with nine species inhabiting diverse natural zones ranging from deserts to foothills. These birds occupy various ecological niches, contribute to seed dispersal, and form an integral part of trophic chains. Additionally, they are of economic importance as game species.

Population status of *Columbiformes* is increasingly recognized as an indicator of ecosystem health. Monitoring these species is especially relevant under conditions of rapid urbanization, habitat transformation, and climate change. While many species adapt well to anthropogenic landscapes, environmental shifts can substantially impact their abundance, breeding timing, and migratory behavior.

To date, there has been a lack of integrated studies in Kazakhstan on the breeding ecology, migratory patterns, and population trends of these birds. Existing information, including that from the foundational work *Birds of Kazakhstan* (1962), requires updating through the application of modern scientific methods. Particular concern is raised by the population decline of the Eastern Stock Dove (*Columba eversmanni*), listed in Kazakhstan's Red Data Book and classified as Vulnerable by the IUCN. A similar negative trend is observed in the European Turtle Dove (*Streptopelia turtur*), whose population has declined by 30-49% in Europe over the last 15-16 years.

This study addresses these knowledge gaps through an integrated approach, including field observations, bird ringing, satellite telemetry, and virological analyses. The results have both theoretical value and applied significance for the conservation and sustainable management of vulnerable pigeon and dove species.

Research goal.

To assess the current population status of Columbiformes in Southern and Southeastern Kazakhstan based on analysis of their breeding biology, seasonal migrations, and population trends.

Research Objectives

1. Investigate the breeding biology of pigeons and doves in the region, including nesting range, timing, nest types, and breeding density;
2. Determine the timing, direction, and characteristics of seasonal migrations using visual observations, bird ringing, and satellite tracking;
3. Analyze morphometric parameters with consideration of seasonal, age, and sex-related variations;
4. Evaluate long-term population trends of migratory species using data from the key flyway site – Shakpak Pass in the Western Tien Shan;
5. Assess the potential role of migratory *Columbiformes* as carriers of viral infections.

Study subject.

The study focuses on Columbiformes species (genera *Columba*, *Streptopelia*, and *Spilopelia*) that breed or migrate through Southern and Southeastern Kazakhstan.

Methods.

A multi-disciplinary approach was used, combining field surveys, analytical methods, GIS technologies, and molecular diagnostics. Fieldwork included line and point counts, bird ringing with metal bands, and morphometric measurements (body mass, wing and bill length), followed by statistical analyses. Migration routes were studied through GPS/GSM telemetry and historical migration records at Shakpak Pass. Spatial analysis was conducted using QGIS, while statistical processing was performed in R.

Scientific novelty

- Up-to-date data on the breeding biology of eight species: distribution, timing and density of nesting, nest types, and habitat associations;
- First reconstruction of autumn migration routes for *C. eversmanni*, *C. palumbus*, and *C. oenas* using GPS telemetry, identifying flight directions, durations, speeds, altitudes, and stopover sites;
- First morphometric analysis of over 20,000 individuals, revealing statistically significant seasonal, age, and sex-based differences;

- First quantitative evaluation of long-term ringing and migration count data from Shakpak Pass, identifying population trends in migratory *Columbiformes*;
- First molecular detection of coronaviruses, paramyxoviruses, and astroviruses in wild *Columbiformes* in Southern and Southeastern Kazakhstan.

Scientific and practical significance

The research provides a significant contribution to the understanding of the ecology, distribution, and migration of pigeon and dove species in the region. For the first time in Kazakhstan, an integrated approach combining satellite tracking, ringing, and morphometry has been applied to clarify the spatial and seasonal dynamics of populations. Tracking of rare taxa, including *C. eversmanni,* identified migration corridors and stopover sites requiring protection. Results are applicable to species and habitat conservation, planning, environmental education, and risk assessment of virus transmission. New data on the number, breeding, and migrations of C. eversmanni have been incorporated into the updated Kazakhstan Red Data Book. The dataset underpins conservation strategies, sustainable population management, and rational use (eco-tourism, game management).

Key Findings Defended in the Dissertation

- Nesting of nine Columbiformes species was confirmed in the study area. Resident species (*C. livia*, *St. decaocto*, *Sp. senegalensis*) initiate breeding as early as February and can produce 3–4 broods per season. Migratory species (*C. eversmanni*, *St. turtur*, *St. orientalis*) begin nesting in late March or early April, with 1–2 breeding cycles;
- The highest breeding density was recorded for the Rock Dove (*C. livia*) in urban parks and woodlands. The nesting of *C. eversmanni* in the Ili River Delta (Zheltorangi village) was confirmed, with a density up to 1.5 nests/km²;
- Spring migration occurs in April–May, autumn migration in September–October. Autumn migration of *C. oenas*, *St. orientalis*, and *St. turtur* follows a southwestward route through Chokpak Pass. Spring numbers of *C. oenas* at Chokpak were significantly lower, suggesting a different return route or partial local settlement. GPS tracking showed *C. eversmanni* covering up to 1335 km in 36 days en route to India and Pakistan;
- Contrary to prior assumptions, *C. eversmanni* was observed roosting on rooftops in populated areas during migration, indicating behavioral flexibility and reduced aversion to human environments;

- Long-term analysis at Chokpak revealed divergent population trends: increases in *C. palumbus* and *C. livia*, stability in *St. decaocto* and *St. orientalis*, declines in *C. oenas* and *St. turtur*, and critical endangerment of *C. eversmanni*;
- Wild pigeons and doves in Southern Kazakhstan were confirmed as potential carriers of coronaviruses, paramyxoviruses, and astroviruses, emphasizing their relevance to avian disease ecology. RNA viruses were detected in samples from 29 individuals of five species (PCR positives: coronaviruses 2 inds., 6.9%; paramyxoviruses 1 ind., 3.4%; astroviruses 1 ind., 3.4%).

Project integration

The dissertation was conducted as part of national research projects by the Institute of Zoology of the Ministry of Science and Higher Education of the Republic of Kazakhstan:

– AP09260933 “Monitoring Migratory Birds and Avian-Borne Viral Infections in Southeastern Kazakhstan” (2021–2023);

– BR21882199 “Inventory of Wildlife in the Balkhash-Alakol Basin with Assessment of Threats to Conservation and Sustainable Use” (2023–2025).

Fieldwork, telemetry, and morphometry were conducted at the Laboratory of Ornithology and Herpetology, while virological testing was performed at the Research and Production Center for Microbiology and Virology.

Author’s contribution

The author personally participated in bird ringing at Chokpak Pass and biological sample collection, independently analyzed breeding data, processed telemetry results, generated migration maps, and performed movement modeling. Relevant databases (IUCN, GBIF, eBird, kz.birding.day) were consulted. All major sections of the dissertation were written by the author.

Dissemination

Research results were presented at the following international conferences:

- “Farabi Alemi” Student Conference (2022, Almaty);
- 90th Anniversary Conference of the Institute of Zoology (2023, Almaty);
- 7th Eurasian Ornithological Congress (2023, Izmir, Turkey);
- 2nd Asian Ornithological Conference (2024, Beijing, China).

Publication

Thirteen scholarly works have been published, including 5 conference abstracts and 3 full papers in international conference proceedings, 3 articles in Ministry-recommended journal of *Experimental Biology (KazNU)*; 2 articles in international journals *Ardea* and *Biodiversitas* (indexed in Scopus and Web of Science).

Structure of the dissertation

The dissertation consists of an introduction, three main chapters, a conclusion, and references (168 sources). The main text is 114 pages long and includes 9 tables, 63 figures.