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Distribution and Species Diversity of the Dove Genus *Streptopelia*: A Systematic Review

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Abstract

The genus *Streptopelia* is one of the largest and taxonomically complex in the family Columbidae, consisting of approximately 15–18 species with heterogeneous ecological requirements and distribution ranges. This systematic review compiles up-to-date knowledge on the worldwide distribution, species diversity, phylogeny, and conservation status of *Streptopelia* doves, based on the most recent molecular, ecological, and biogeographical studies. We investigated distribution, systematics, phylogeny, and anthropogenic effects for this genus. Phylogenomic studies have resolved the identity of many taxonomically uncertain species, uncovered complex patterns of speciation, and revealed cryptic diversity in so-called species complexes.

Some species, such as the Eurasian Collared-Dove (*S. decaocto*) are fast expanding around the planet, while others, such as the European Turtle-Dove (*S. turtur*), are experiencing precipitous population declines. Climate change, habitat loss, greater cultivated areas, and hunting pressure are the major threats to the diversity of *Streptopelia*. A few species require urgent conservation action. Priority for subsequent research should be to redress outstanding taxonomic uncertainties, ascertain the effect of climate change on distributions, and put in place conservation measures for declining taxa. We provide here a detailed review on how it is possible to understand the diversity of *Streptopelia* and how such an understanding can contribute to conservation strategies of this key dove genus from both ecological and economic viewpoints.

Keywords: *Streptopelia*, dove diversity, biogeography, phylogeny, distribution & conservation, Columbidae.

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1. Introduction

Doves belonging to the genus *Streptopelia Linnaeus*, 1758, are one of the most ecologically diverse and widely spread clades in the family Columbidae (1; 2). The genus *Streptopelia* is distributed throughout Europe, Asia, and Africa and is human-introduced in North America and Australia, and found in a wide range of habitats from desert to urban areas, showing excellent ecological plasticity (3; 4). The genus attracted a great deal of attention as an appealing model from a scientific point of view for its taxonomic complexity, rapid radiation, and varied responses to anthropogenic environments (5;6). Recent advancements in molecular phylogenetics and genomics brought to light new discoveries that call for a reconsideration of *Streptopelia* systematics: indeed, previously undescribed species limits and complex mechanisms of speciation were identified (7). At the same time, field studies have documented large distributional shifts and population and conservation status changes for several species in the genus (8). Get access to the contrasting arrivals of the expanding invader, the Eurasian Collared-Dove (*S. decaocto*), and the declining native species, the European Turtle-Dove (*S. turtur*), are representative of the conservation

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challenges of this taxonomic group, under these conditions (9). Patterns of distribution and diversity in *Streptopelia* need to be known for several reasons. First, the seed dispersers and prey of these species have important ecological functions in the biomes they inhabit (10). Second, some of the species are favored as game birds, providing a large hunting economy and at the same time causing concern for conservation (11).

Finally, the genus represents a great study model for fast evolution, biological invasions, and climatic resistance (12). To address this goal, we conducted a systematic review to consolidate the currently available information on the worldwide distribution, species richness, phylogenetic relationships, and conservation status of *Streptopelia* doves. We summarize recent knowledge on the evolutionary history of the genus, current distribution and population trends, and the primary threats and conservation issues, and we establish research and conservation priorities.

2. Methodology

This review follows standard guidelines for systematic literature synthesis in ornithology and conservation biology. The search was conducted in major databases (Web of Science, Scopus, PubMed, Google Scholar), according to different combinations of search terms (e.g., '*Streptopelia*,' 'dove,' 'Columbidae,' 'distribution,' 'diversity,' 'phylogeny,' 'conservation,' 'biogeography') and a procedure was adopted to systematically search all available records. Publication searches ranged from 2001 to 2024, with an emphasis on those published after the year 2015 to include recent molecular systematic and conservation research.

Literature inclusion criteria: Literature meeting the following criteria was included in the review: 1) peer-reviewed scientific journal papers, 2) studies on the ecology, systematics, biogeography, or conservation… of *Streptopelia* species, 3) papers that provide quantitative data or useful new information, and 4) papers that described methods well. Reviews that contain no new data have been excluded, as have conference abstracts and non-peer-reviewed sources. Emphasis was placed on new phylogenomic studies, large-scale ecological analyses, and complete conservation assessments.

The extraction/database concentrated on taxonomic data, distribution, trend of the population, ecological demands, relationships, and conservation status, threats, respectively. Distribution information was gathered from taxon accounts, range maps, and citizen science online databases (including eBird (13). Conservation status was retrieved from the IUCN Red List (IUCN, 2023) and the species factsheets of BirdLife International (BirdLife International, 2024).

3. Taxonomic Diversity and Systematics

3.1 Current Taxonomic Framework

The genus *Streptopelia* currently contains 15-18 accepted species, depending on the taxonomic authority, with ongoing arguments, species limits, and phylogenetic relationships (14). Recent phylogenomic studies have yielded substantial clarity of phylogenetic relationships among the species of the genus and resolved some of the longstanding taxonomic conundrums, identified new conundrums (15).

The genus has a pronounced biogeographical structure with well-defined African, Eurasian, and Oriental clades that reflect the historical processes of speciation and dispersal. Dating by the molecular clock indicates that *Streptopelia* radiation began in the Miocene (15-20 million years ago) and that the principal extant species diverged in the Pliocene and Pleistocene (16).

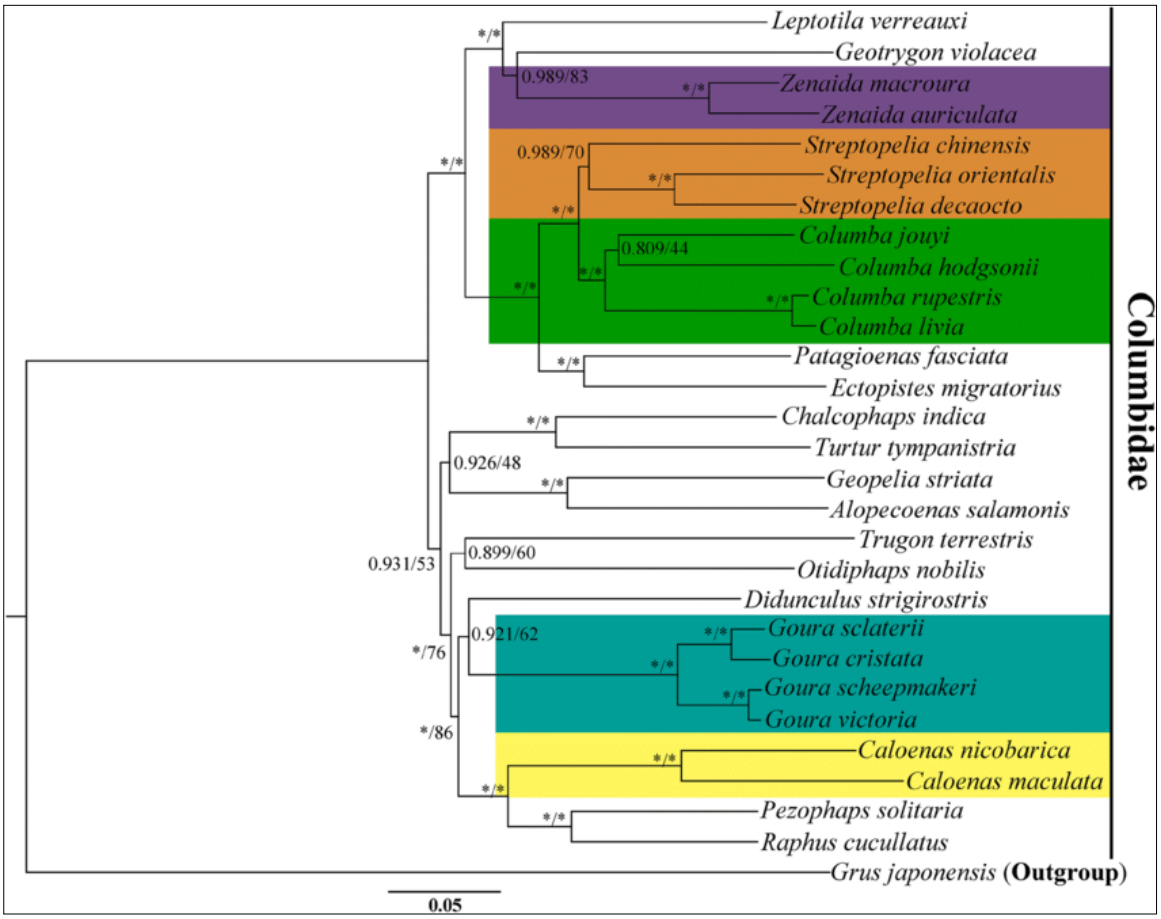

Figure 1. Nucleotide-based phylogenetic tree showing relationships among Columbidae species, including Streptopelia taxa. Source: (Rafiq et al., 2020).

Many groupings of *Streptopelia* are now potentially known to encompass previously unrecognized taxonomic diversity. The *S. turtur* complex is highly structured over its distribution, and some populations may correspond to different species (17;18). On the other side, the *S. decaocto* complex shows complex phylogeographic patterns, and many introduction events and hybridization zones that confuse taxonomic boundaries (19; 20). Recent molecular studies reveal paraphyly and cryptic speciation in the S. capicola and S. semitorquata formal groups in Africa, hence these need a taxonomic overhaul (21). A synthesis of taxonomic methods (morphologic, acoustic, ecologic, genetic) is required to reconcile these taxonomic uncertainties and establish a consensus species limit (16). *Streptopelia* Species are:

3.3.1 European Turtle Dove (*Streptopelia turtur*)

The European Turtle Dove (*Streptopelia* turtur) is a trans-Saharan migrant that breeds in European populations and migrates to sub-Saharan Africa for the winter (BirdLife International, 2023). Europe. In most of its European range, this species has shown a large decline in population size, which is more than 30% in 16 years (three generations), and the species has been uplisted to Vulnerable (BirdLife International 2023). In the United Kingdom, the number of turtle doves has fallen by over 90% in the past 50 years, and it is now the UK's fastest–declining bird species (RSPB, 2022).

3.3.2 Oriental Turtle Dove (*Streptopelia orientalis*)

One of only two migratory species of the genus, the Oriental Turtle Dove breeds in temperate zones while wintering in tropical zones (22). It is found in Asia, ranging from India to China and Japan, and it demonstrates that the genus is amenable to diverse climatic conditions.

3.3.3 Dusky Turtle Dove (*Streptopelia lugens*)

East Africa—southern Sudan, Ethiopia, Uganda, Tanzania, Malawi—with disjunct populations in Yemen and southern Saudi Arabia. It occurs in montane forest, forest edges, and woodland gardens at elevations between 1,800 and 3,200 meters (Collar & Robson, 2020).

3.3.4 Adamawa Turtle Dove (*Streptopelia hypopyrrha*)

Also known as the Pink-bellied Turtle Dove, closely related to S. lugens. It has a disjunct distribution in Cameroon, Nigeria, southwestern Chad, and westward into Gambia, Senegal, and Mali (23).

3.3.5 Philippine Collared Dove (*Streptopelia dusumieri*)

Occurs in the Philippines, locally called bato-bato de collar. Introduced populations exist on Guam and the Northern Mariana Islands; the Guam population declined sharply due to invasion by brown tree snakes. IUCN lists it as Vulnerable, with ongoing decline mainly from interspecific competition with spotted and Red-collared Doves (BirdLife International, 2022).

3.3.6 Sunda Collared Dove (*Streptopelia bitorquata*)

The Sunda Collared Dove is a medium-sized species native to the Indonesian archipelago, ranging from Java and Bali to the Lesser Sunda Islands. It is characterized by uniform grey-brown plumage, a narrow black collar, and dark eyes, making it somewhat inconspicuous compared to other collared doves (24).

3.3.7 Eurasian Collared Dove (*Streptopelia decaocto*)

Characterized by a light grey body, black neck ring, and reddish eyes, the Eurasian Collared Dove has undergone an impressive range expansion from its original Asian habitat to Europe, and eventually North America, following introductions to the Bahamas in the 1970s (25). Its versatile nature means that it can often flourish in urban and agricultural habitats.

3.3.8 Burmese Collared Dove (*Streptopelia xanthocycla*)

Newly elevated to species level, the Burmese Collared Dove can be distinguished from *S. decaocto* by its yellow orbital ring and darker coloration. It is found in lowland Myanmar and adjacent regions (IOC, 2021; Rasmussen & Anderton, 2023).

3.3.9 African Collared Dove (*Streptopelia roseogrisea*)

The domestic Ring-necked Dove originates from this pied species, which inhabits the Sahel and the Horn of Africa. Its underparts are pinkish, and its black collar is classic; it is a typical species of Zambi, and it prefers to be in arid places close to water.

3.3.10 White-winged Collared Dove (*Streptopelia reichenowi*)

These unique East African species are characterized by their slaty-grey feathers, with striking white patches on the wings, which are most easily spotted in the air. It lives in lowland moist forest and dry scrub, and it is losing habitat (26).

3.3.11 Mourning Collared Dove (*Streptopelia decipiens*)

A bird of the larger doves (up to 32 cm), the MGCD has a black nape collar, pale pinkish body underparts, and dark primary bases and outer wings. It is widely distributed in sub-Saharan Africa, particularly near water sources, and is distinguished by its plaintive, repeated cry (27).

3.3.12 Red-eyed Dove (*Streptopelia semitorquata)*

The red-eyed dove is plump with a heavy build, red eyes, and a deep-cooing voice. It is found in a wide range of forests and gardens throughout most of sub-Saharan Africa and is common in both humid river valleys and uplands (28).

3.3.13 Ring-necked Dove (*Streptopelia capicola*)

This widespread dove of eastern and southern Africa is pale grey to buff with a black collar to nape and square-tipped tail. It is largely non-migratory and

prefers open terrain such as savannas and farmland (29).

3.3.14. Vinaceous Dove (*Streptopelia vinacea*)

Small, stocky species with vinaceous-pink breasts and a black underwing visible in flight. It is found in dry savanna and scrub throughout the northern sub-Saharan Africa (30).

3.3.15. Red Collared Dove (*Streptopelia tranquebarica*)

The male Red Collared Dove has a rosy wine-red feather color and a gray head with a black collar. Native to South and Southeast Asia, the females are less distinct. It is found in open land, cultivated areas, and ricefields (31).

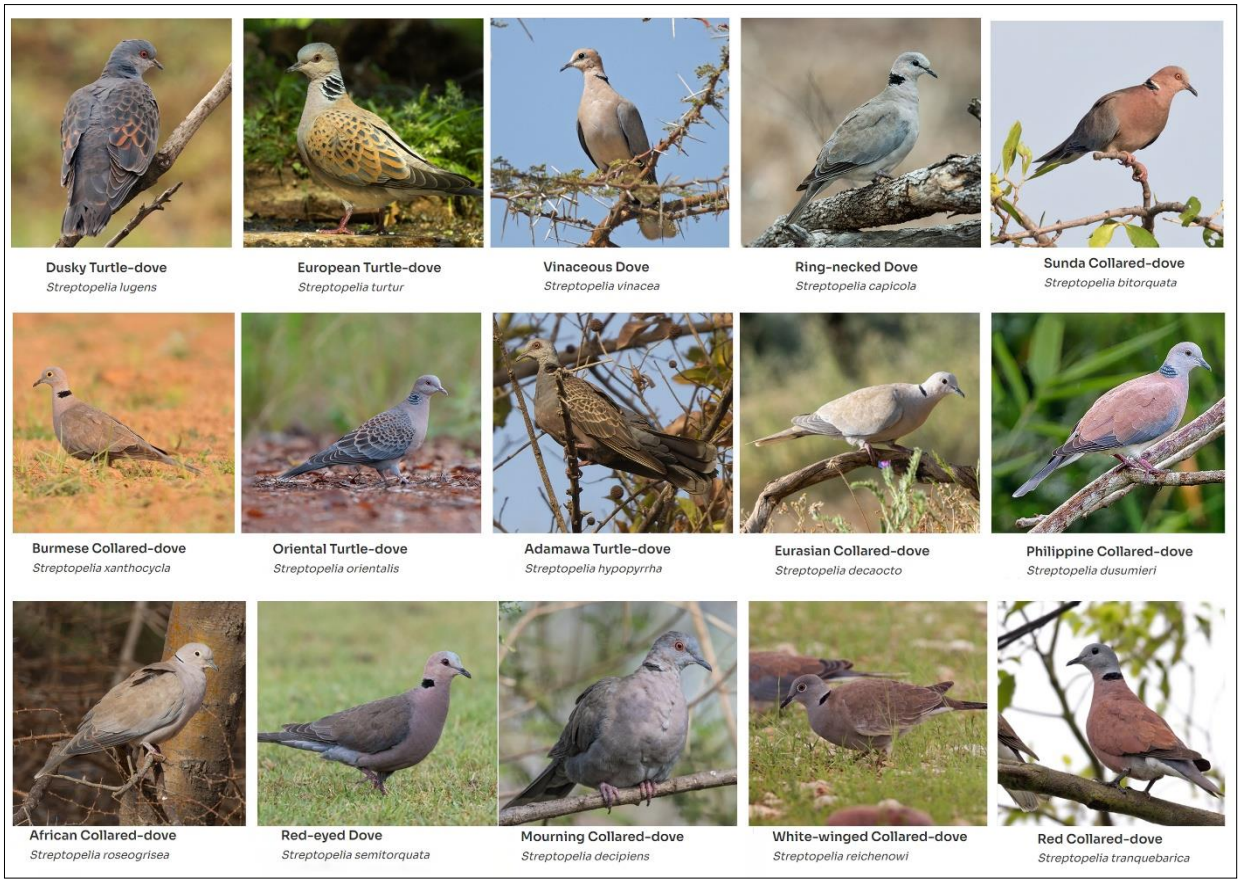

Figure 2: Pictures of different species within the genus Streptopelia, reprinted from BirdLife International (2025). Retrieved from https://datazone.birdlife.org

3.4 Hybridization and Introgression

Hybridization is also an important factor in the evolution and taxonomy of *Streptopelia*, with hybrid zones known between some species pairs (32). *S. decaocto* and S. roseogrisea hybrids are produced in the wild in North Africa, underlining conservation concerns that need to be raised on behalf of pure populations of the latter species (33). Analogue hybridization has been reported between S. orientalis and *S. turtur* in sympatry, but the importance and evolutionary impact of gene flow are very poorly understood (34). Human-aided habitat transitions have facilitated hybridization events, providing allopatric species with the chance to meet. This is a conservation challenge for the preservation of species integrity, as well as an opportunity for the study of speciation in action (35).

4. Global Distribution Patterns

4.1. Native Distribution Ranges

Distribution of *Streptopelia*: The *Streptopelia* are distributed in genera, and their distribution is

correlated with their evolutionary process and ecological adaptations. Africa harbors the highest species diversity of the genus, with at least 8-10 species, while 6-8 species are known from Asia and 2-3 more regularly from Europe (36).

The European Turtle-Dove (*S. turtur*) that is the focus of this study is the best investigated species in distribution ecology, as detailed mapping has been used to show complex patterns of range shrinkage and fragmentation (37). Satellite tracking investigations have revealed exact migration routes that link European breeding sites with African wintering locations, mainly in the Sahel region (38). This range and migration orientation are depicted in Figure 3, which details both summer and winter ranges of the species in Europe.

4.2 Range Expansions and Invasions

The Eurasian Collared-Dove (*S. decaocto*) is one of the most spectacular examples of the spreading of ranges occurring in modern ornithology (40). In historical times, it was found in Turkey and the Balkans, and after the early 20th century, a large western and northern spread occurred throughout Europe (41).

Introduction to North America was in the 1980s, and subsequent explosive population dynamics with range expansion throughout the continent (42). It has now become distributed from southern Canada to central Mexico, with extraordinary potential for adaptation to varying climates and ecological habitats. Population genetic studies indicate that the invasion in North America was supported by numerous introductory events from several European source populations, which may explain the success of the invasion through the introduction of enhanced genetic variation. This swift colonization is captured in Figure 4, which illustrates the sequential infestation of the species throughout North America starting in 1990.

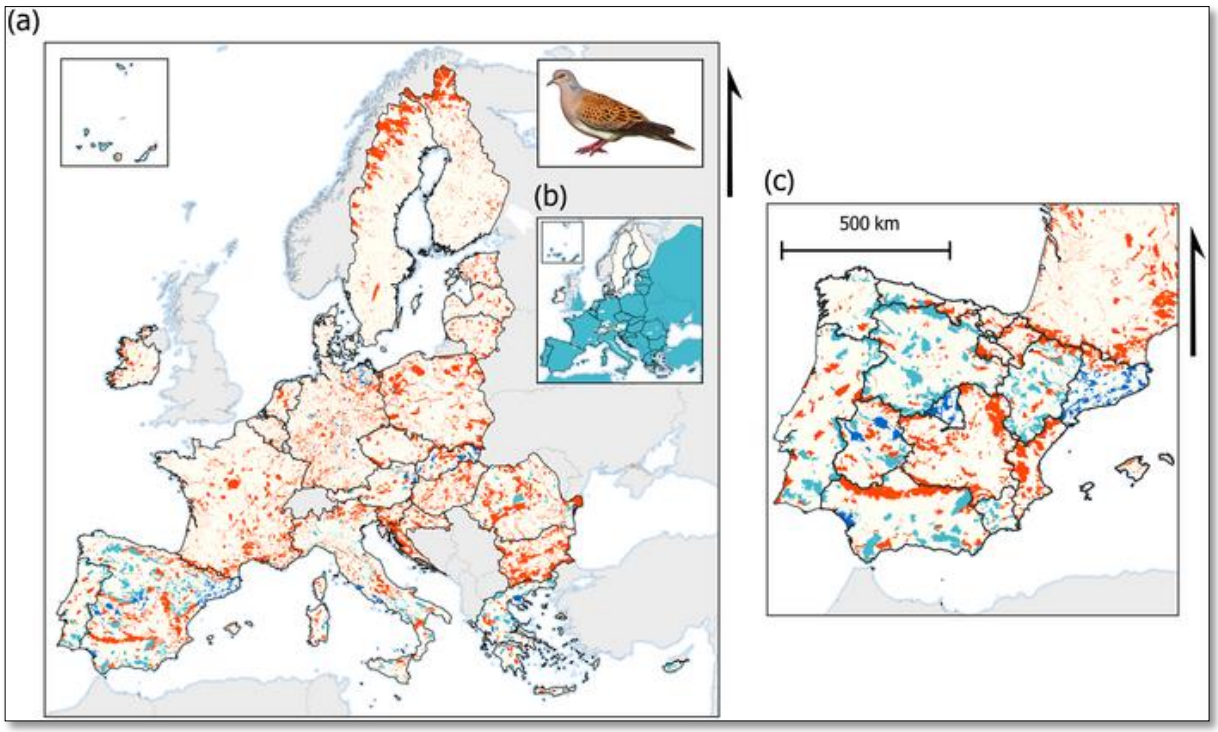

Figure 3. Range and breeding distribution of the European Turtle-Dove (Streptopelia turtur). Source (39).

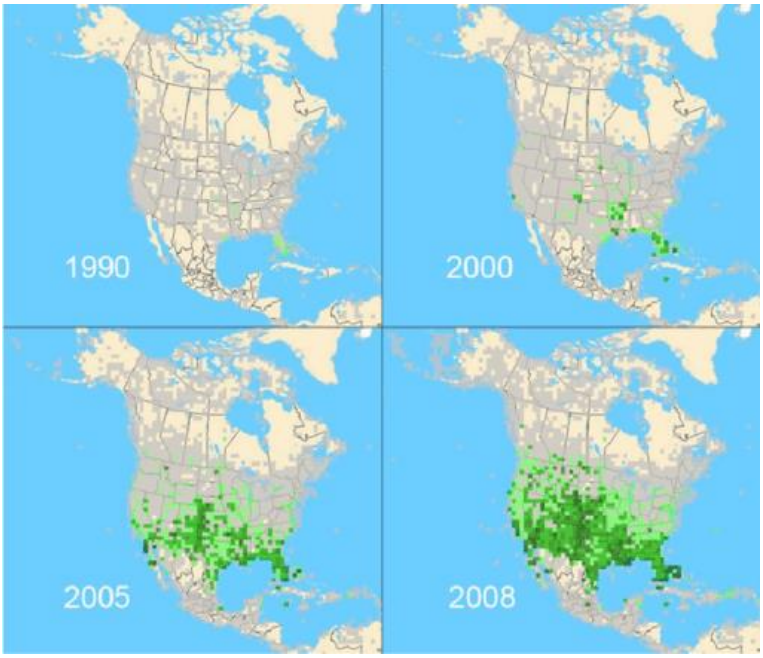

Figure 4. Eurasian Collared-Dove (Streptopelia decaocto) frequency distribution across North America showing invasion success. Source: (43).

4.3 Range Contractions and Local Extinctions

While *S. decaocto* is increasing its range, several other *Streptopelia* species are undergoing dramatic range contractions and population losses. The European Turtle-Dove has experienced a decline of between 70% and 80% of its breeding population in Europe since 1980, with reductions in its distribution throughout most of its historical range (44).

Similar declines have been reported for the Laughing Dove (*S. senegalensis*) in parts of its Asian range, attributed to habitat loss and degradation. The Madagascar Turtle-Dove (*S. picturata*) faces significant conservation challenges due to habitat destruction and introduced species, with genetic diversity studies revealing concerning levels of population fragmentation (45).

5. Ecological Requirements and Habitat Associations

5.1. Habitat Preferences

Streptopelia species exhibit diverse habitat preferences, ranging from arid scrubland to dense forests and urban environments. Most species show preferences for edge habitats and semi-open landscapes, combining requirements for nesting sites (typically trees or shrubs) with feeding areas (open ground or grasslands) (46).

The European Turtle-Dove shows strong associations with farmland mosaics containing hedgerows, small woodlands, and extensive agricultural areas. Detailed habitat selection studies reveal preferences for areas with high plant species diversity, particularly those supporting seed-producing plants that form the species' primary diet (47).

Urban adaptation has been documented in several *Streptopelia* species, with the Eurasian Collared-Dove showing exceptional success in urban environments. Comparative studies reveal significant behavioral and physiological adaptations to city life, including altered feeding behaviors, nest site selection, and stress responses (48).

5.2 Dietary Ecology

Streptopelia species are mainly granivorous, with a diet mainly based on seeds of grasses, herbs, and cultivated crops (49). However, temporal and geographical variation in diet composition is large, and some species also consume substantial amounts of green plant material, fruits, and even invertebrates. Agricultural intensification has exerted strong effects on the food availability of several *Streptopelia* species, showing decreasing seed abundance and diversity in intensively managed farmlands (50). The decrease in access to wild plant seeds has been pointed out as an important driver of the declining population trend in several species, namely the European Turtle-Dove (51).

5.3 Breeding Ecology

Typical attributes of *Streptopelia* members include, but are not limited to, prolonged reproductive periods, simplified nest construction, and short reproductive cycles. As with many other bird species, the average number of eggs in a clutch is 2, and multiple clutches can be laid in a season, particularly in areas where conditions are good. Nest sites are species-dependent but usually consist of simple platform nests built on trees, shrubs, or rarely on artificial structures, comparative studies of breeding performance of urban and rural populations showed mixed results: While the urban habitat may provide reduced predation risk, the environment may also expose birds to stress and contamination, Breeding phenology of the species is being affected by climate change where warming temperatures have resulted in earlier breeding (52).

6. Population Trends and Conservation Status

6.1 Population Monitoring and Trends

Population monitoring also reflects a diversity of trends among species of *Streptopelia*, some of which appear to show striking increases, while others seem to be undergoing serious declines. Dense, long-term spatio-temporal monitoring data from European breeding bird surveys show that numbers of European Turtle-Doves fell by 78% from 1980 to 2015, making this one of Europe's most rapidly decreasing bird species, This precipitous decline is echoed to some extent by satellite-tracked migration routes (Fig. 5) that emphasize how much distance and how many stopovers are necessary for the species' survival.

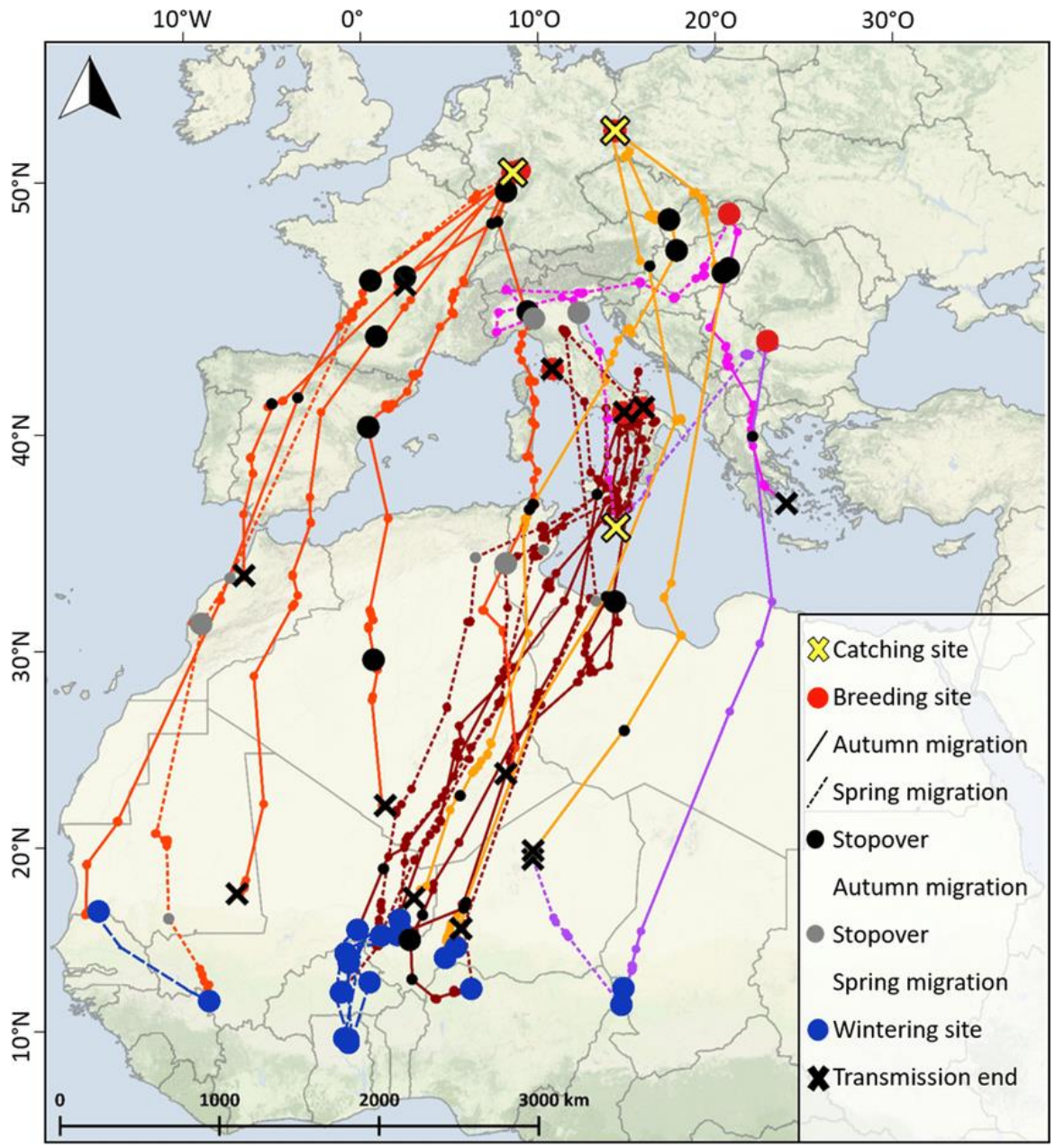

Figure 5. Satellite tracks of 13 European Turtle-Doves (Streptopelia turtur) during migration between breeding and wintering grounds. Source:(53)

Demographic analyses identify multiple factors contributing to population declines, including reduced breeding success, increased adult mortality, and habitat degradation (54). Detailed population models suggest that current decline rates are unsustainable, with local extinctions predicted for many European populations within 20-30 years without immediate conservation intervention.

6.2 Conservation Status Assessments

Current IUCN Red List assessments classify three *Streptopelia* species as globally threatened: the European Turtle-Dove (Vulnerable), Madagascar Turtle-Dove (Near Threatened), and Socorro Dove (Extinct in the Wild, though this species is sometimes placed in a separate genus) (IUCN, 2023). Several other species face regional conservation concerns, with significant population declines documented across portions of their ranges.

The European Turtle-Dove has been the focus of intensive conservation research and planning, with species action plans developed at national and international levels. Nevertheless, bird conservation

faces challenges related to its trans-Saharan migratory pattern, which demands international and continent-wide cooperation of many countries (54).

6.3 Threats and Limiting Factors

Habitat loss and degradation constitute the main threats to most [[*Streptopelia*]] species, and agricultural intensification is considered a particularly important driver of population declines (55). Traditional extensive farming systems have been replaced by intensive monocultures with negative impacts on nesting habitat and food availability for many species, Hunting pressure has an impact upon several *Streptopelia* species: the European Turtle-Dove, for example, is reported to suffer serious hunting mortality on Mediterranean flying, in some nations, sustainable hunting quotas have been set but enforcement of such quotas remains problematic (56).

Climate change represents an emerging threat, with species distribution models predicting significant range shifts and contractions under future climate scenarios, Particularly concerning are projections for African wintering grounds, where increased aridity could reduce habitat suitability for several migratory species, Disease outbreaks, particularly trichomonosis caused by *Trichomonas gallinae*, affect several *Streptopelia* species and may contribute to population declines, Urban populations appear particularly vulnerable to disease transmission due to increased contact rates at feeding sites (57).

Habitat loss and degradation represent the primary threats to most *Streptopelia* species (see **Figure 6**), with agricultural intensification identified as a particularly significant driver of population declines.

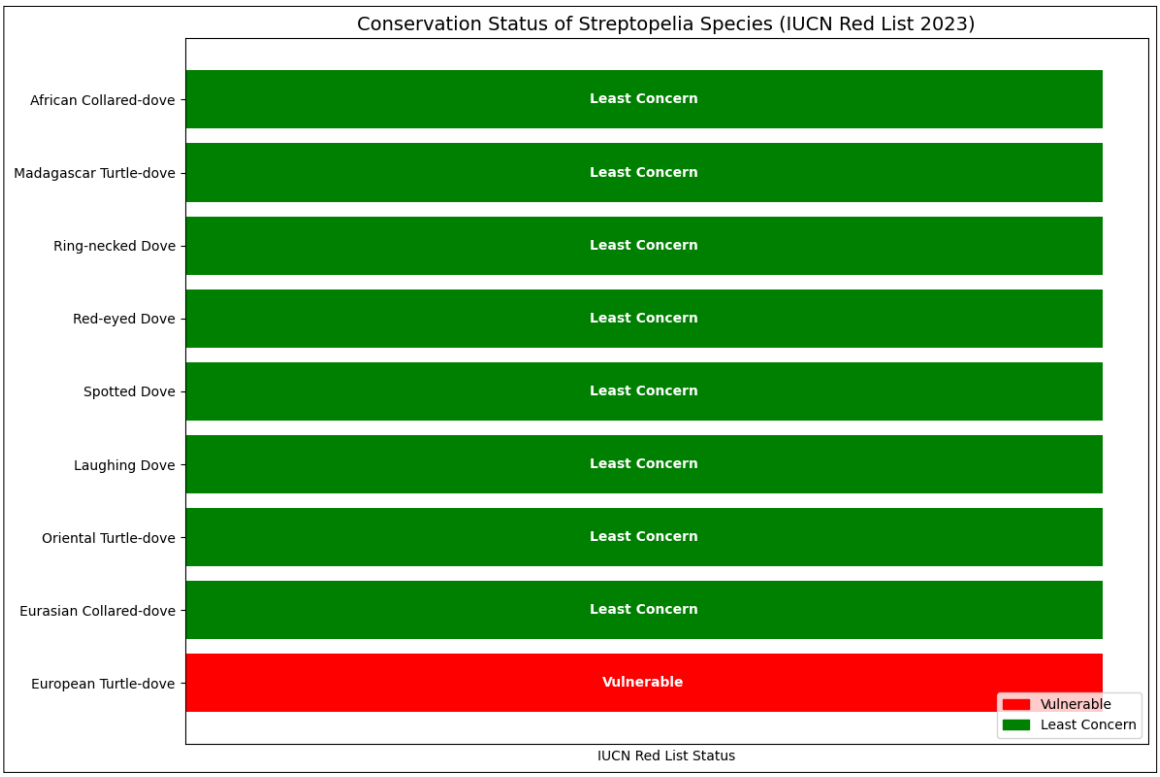

Figure 6. Conservation status of major Streptopelia species according to IUCN Red List 2023 assessments.

7. Climate Change Impacts and Future Projections

7.1 Observed Climate Change Effects

Climate change is already affecting *Streptopelia* species through multiple pathways, including shifts in breeding phenology, altered migration timing, and changes in suitability in habitat suitability. Long-term datasets reveal earlier breeding initiation in several species, with advancement rates of 2-4 days per decade documented across European populations (58).

Migration phenology is also shifting, with earlier spring arrival and later autumn departure observed in several species. Nevertheless, changes in the timing of movement may not be synchronized with changes in resource availability, in which case time-lags may lead to a decoupling between peak food availability and breeding activity (59).

8. Conservation Strategies and Management

8.1. Habitat Management

The successful conservation of species of *Streptopelia* will be the result of habitat management strategies that are custom-made for ecological needs and constraints. species of farmland, such as the European Turtle Dove, conservation is needed to maintain and restore the traditional agricultural landscape featuring a high degree of habitat heterogeneity. Agri-environment schemes have proved to be successful at â€˜fostering *Streptopelia* populations by setting up seed-rich plots, maintaining hedgerows and leaving stubble fields€™ open, but the success of these activities varies geographically and is likely to require adaptive monitoring and management to reflect local conditions and responses of species (60).

8.2 Species-Specific Action Plans

There are full species action plans for the most threatened *Streptopelia* species, including habitat management, population monitoring, task planning, and research needs. The European Turtle-Dove Action Plan is the most comprehensive and largest-scale conservation plan on the bird involving 42 countries across the breeding and wintering range of the species. Priority conservation actions highlighted in species action plans include habitat restoration and management on the breeding grounds, safeguarding of stopover sites during migration, sustainable management of the wintering grounds in Africa, regulation of hunting pressure, and long-term population monitoring (61).

9. Research Priorities and Future Directions

9.1. Taxonomic Research

Further taxonomic study is required to clarify species limits and phylogenetic relationships among taxa of *Streptopelia*, particularly among the complexes of African species, Genomic, morphological, vocal, and ecological data should be incorporated, as integrative analyses are paramount to set up stable taxonomic frames that allow adequate conservation planning, Priority species complexes necessitating taxonomic revision are the S. capicola complex, S. semitorquata group, and Asian populations of S. orientalis (62). Resolution of taxonomic uncertainties is fundamental for adequate evaluation of conservation status and allocation of conservation resources.

10. Conclusions

The *Streptopelia* doves provide both a cautionary tale and hope for avian biodiversity in the Anthropocene. Although some, like the Eurasian Collared-Dove, have been extremely successful in human-altered habitats, others, like the European Turtle-Dove, are threatened with imminent extinction. This discrepancy is indicative of complex interactions between species' ecological needs, evolutionary relationships, and anthropogenic environmental alterations. Recent developments in phylogenomics have disentangled the evolutionary relationships of *Streptopelia* and helped identify so far unnoticed taxonomic diversity. These results represent critical first steps in efforts to prioritize species for conservation planning, but also underscore the urgency of further taxonomic research, especially within African species complexes. The observed patterns of rapid range expansion and loss in the

genus offer important clues to the forces that may influence species' responses to environmental change.

Climate change presents as a key threat multiplier that may intensify existing threats from habitat loss, hunting, and disease. SDMs forecast striking range shifts and contractions for most *Streptopelia* species, with implications for conservation planning and international cooperation. Adaptation needs to consider the entire annual cycle of species that are migratory and work with the uncertainties in projections of climate. International cooperation, integrated conservation and management strategies are required to address threats within species' ranges (both breeding and wintering grounds). Progress in the development of comprehensive species action plans is promising, but the different capacities and priorities of countries make the implementation of these plans very difficult. Urban areas may be increasingly important for species conservation, functioning as both refugia and corridors for species movement.

Key research needs are to clarify remaining taxonomic uncertainties, understand the impacts of climate change and how species may adapt to it, and develop effective conservation interventions, including the application of technology to monitoring and management. These divergent conservation trends in *Streptopelia* have now become natural experiments to gain insights into the variables that favor or disfavor species in an evolving landscape. In the end, the maintenance of *Streptopelia* diversity will largely be determined by our capacity to address the interacting threats that species face while retaining the ecological processes and landscapes necessary to secure their continued existence. The genus represents a model for the complex of challenges facing conservation and insights into how to save birds more generally, in a quickly changing world.

Conflict of interest: NIL

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