



## Current Population Status, Habitat Distribution, and Threats to Black (*Francolinus francolinus*) and Grey (*Francolinus pondicerianus*) Francolins in Nara District, Khairpur, Sindh

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### Declaration

### Authors' Contribution

All authors equally contributed to the study and approved the final manuscript

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### ABSTRACT

The ecological importance of the francolins in the South Asian ecosystems is the game birds, which are well known to play a role in the agro ecological system and also in providing a culture. The Black (*Francolinus francolinus*) and the Grey (*Francolinus pondicerianus*) Francolins are however becoming extinct due to hunting, habitat destruction as well as agricultural intensification. This research is a case study carried out in Nara District, Khairpur, Sindh which assesses the present population status, distribution of habitat and other threat to the species. International surveys were conducted in semi-arid croplands, scrublands, desert margins, irrigated croplands and riverine belts in the form of transects and point counts. The findings explores that the Grey Francolin is extensive with the greatest densities in semi-arid croplands and scrublands due to its flexibility towards fragmented habitats and to the capacity to survive human activity. Although Black Francolins were restricted in a few areas told by the irrigable crops and along rivers and highlighted their reliance on water and thick cover. Statistical tests showed that the two species have a major difference in the choice of habitat. Comparative evaluation of previous regional survey indicates that the population of the Grey Francolin is relatively steady, on the other side, the population of Black Francolin is more sharply decreased in Sindh, which indicates their susceptibility. These results highlight the importance of target species conservation, which involves habitat restoration, regulation of hunting and enlightenment programs. The research would serve as a base reference to the ecology of birds in the Sindh region and be used in greater management projects of biodiversity in Pakistan.

### INTRODUCTION

The game birds like francolins play an ecological, cultural, and economic role in South Asia where they have been extensively exploited as a source of subsistence and as a measure of biodiversity. The most noticeable species include the Black Francolin (*Francolinus francolinus*) and the Grey Francolin (*Francolinus pondicerianus*), which live in a variety of habitats including irrigated and non-irrigated croplands, semi arid scrublands (Ullah et al., 2025; Kumar et al., 2020; Hussain & Khalil, 2023). Their environmental importance as seed dispersers and prey organisms brings to the fore their importance on the ecosystem balance (Ullah et al., 2025).

Past researches have reported population biology and habitat relationship of francolins in various parts of Pakistan. As an example, Black Francolin populations in the Lal Suhana National Park were found to be sensitive

to an environmental change (Ullah et al., 2025), whereas the feeding and breeding ecology of the Greys Francolin in Punjab was found to be adaptable to the human-altered landscapes (Khan et al., 2021; Ullah & Khan, 2021). In the same way, the coverage of Black Francolin was identified as being limited in population density analysis in the Kala Chitta Range

(Basit et al., 2021) but stable in population density analysis in the ecological survey in Totali Game Reserve (Ullah et al., 2025).

Also, the latest research in Kohat focused on species specific habitat selection and population sizes to confirm that the resilience of the species against Black Francolin is resilient (Kakakhel, 2020). A variety of works on the diversity of avifauna in Punjab also indicated the localized loss in connection with hunting and the destruction of habitats (Brraich, Saini, & Singh, 2023). Grey Francolin

population changes are not so extensive in Sindh, whereas black francolin has steeper changes as the threats affect regions differently. The susceptibility of Black Francolin to the anthropogenic alteration of its habitats is also identified during broader analyses of the biogeographic patterns (Kumar, Dewan, Lochan, & Sharma, 2020; Abrha, Rödder, Gedeon, Podsiadlowski, & Töpfner, 2025).

Other than francolins, local avifaunal research gives a framework on conservation of biodiversity (Herpin, Gauchet, Strasberg, & Zuel, 2025). The Salt Range study, which recorded distributional change in the communities of birds, and surveys of the Bunjosa Game Reserve, which increased understanding of the avian diversity in game parks, contributed to the same topic (Sangam Khalil & Hussain, 2021; Awan, Kabir, Ahmad, & Huettmann, 2020). Collectively, these studies highlight the need to have localized ecological analyses to acquire detailed information about the resilience and decline of species.

The current study uses this as its foundation in the determination of the current population status, the distributed habitat, and the threats of Black and Grey Francolins in Nara District, Khairpur, Sindh. This study offers a foundation of conservation planning and will add up to sustainable management of biology diversity in Pakistan as it integrated the field surveys and statistical analysis to give baseline data on conservation planning.

## METHODOLOGY

### Study Area

In March to August 2025, fieldwork was done in Nara District, Khairpur, Sindh, to assess the prevailing population, distributor map habitat of the Black (*Francolinus francolinus*) and Grey (*Francolinus pondicerianus*) Francolins, and the threats and dangers faced by these species. The study area was categorized as agricultural lands, scrublands, desert marginal lands, and riverine belts which are the main habitats that the francolins can have in the area.

### Survey Design and Data Collection

To estimate the density and the distribution of the population in space, line transects and point counts were utilized. Transect lines were set up over representative habitats and point counts were done early in the mornings and late evenings when the francolin activity was at its peak. The observation data were presence of species, size of the flock, habitat type, and human activities (hunting, grazing, and change of land use).

### Data and Statistical Analysis

Data obtained were examined to establish the specific habitats degree of preference, relative abundance, and distributional variation of species. The population densities in each habitat were summarized using descriptive statistics and the significance of the observed patterns tested using the difference in the inferential statistical tests. Comparison of means of population densities was conducted using analysis of variance (ANOVA) to compare the habitat types, and chi square tests were applied to determine the differences in the two species and their usage of the habitat. Spatial variation was presented as distribution maps which were prepared

using the survey information. The procedure was within the avian survey protocols with modification when undertaking game birds in South Asia (Bibby et al., 2000).

### RESULTS

Field survey indicated there is a clear difference in the abundance and habitat distribution between the Black (*Francolinus francolinus*) and the Grey (*Francolinus pondicerianus*) Francolins in Nara District and Khairpur. The Grey Francolin was always more common and had a wider distribution in habitats as compared to the Black Francolin that had limited distribution only being found in irrigated agricultural areas and river basins.

**Table 1**

*Mean Population Density (individuals per hectare)*

Habitat Type	Grey Francolin (Mean ± SE)	Black Francolin (Mean ± SE)
Semi-arid Croplands	4.8 ± 0.6	0.9 ± 0.3
Scrublands	3.9 ± 0.5	0.7 ± 0.2
Desert Margins	2.1 ± 0.4	0.3 ± 0.1
Irrigated Croplands	3.5 ± 0.5	2.6 ± 0.4
Riverine Belts	2.8 ± 0.4	2.9 ± 0.5

### Interpretation

Density of Grey francolin was the greatest in semi arid croplands and scrublands, a fact which validates its ability to adapt to fragmented landscapes. The densities of Black Francolin were quite larger in irrigated croplands and the riverine belts, which indicates the reliance on the availability of water and dense vegetation. The statistical analysis (ANOVA) established the significant differences in mean densities of organisms living in habitats ( $p < 0.05$ ).

**Table 2**

*Habitat Occurrence (% of Total Sightings)*

Habitat Type	Grey Francolin (%)	Black Francolin (%)
Semi-arid Croplands	34	12
Scrublands	28	9
Desert Margins	15	4
Irrigated Croplands	13	38
Riverine Belts	10	37

### Interpretation

Grey Francolin was seen in all the surveyed habitats with the most common occurrence in the scrublands and croplands. The place of Black Francolin was closely linked with irrigated croplands and riverine belts besides almost 3/4 th of all sightings. Significant differences in the use of different habits between the two species were confirmed using Chi square analysis (2,  $p < 0.05$ ).

**Table 3**

*Comparative Abundance Trends*

Species	Present Study (Nara District)	Previous Regional Studies	Variation
Grey Francolin	Stable, widespread	Stable in other provinces	Consistent
Black Francolin	Declining, restricted	Moderate elsewhere	Lower in Sindh

### Interpretation

Grey Francolin population is stable in regard to ecosystems of the past where they have been reported to inhabit. Black Francolin, in turn, have much steeper declines in India in Sindh than in the north of Pakistan, indicating a weakness of the region and requiring specific conservation efforts.

## DISCUSSION

The current research points out to inducement of distinct ecological distinctions between the species of the Grey Francolin (*Francolinus pondicerianus*) and Black Francolin (*Francolinus francolinus*) within the Nara district at Khairpur. The population of the Grey francolin was observed to be the same and widely spread in the semi arid croplands and scrublands, meaning that it was adaptable to the fragmented landscapes. Contrastingly, Black Francolin showed limited distribution which was mostly concentrated in irrigated arable areas as well as upper riverine belts and highlights its reliance on the availability of water and thick vegetation. The results are also based on previous studies of avian resilience in wetlands and agro ecosystems of Sindh (Ullah et al., 2025; Kaleri et al., 2023; Das, Srivastava, & Hore, 2025; Bhoi et al., 2025).

Hunting became one of the key triggers of the fall of the two species. Grey Francolin, despite the widespread hunting, proves to be tolerant to the moderate hunting pressure by having a wider range of habitats (Ullah et al., 2025). Black Francolin, though, is disproportional since the limited distribution increases the population to overexploitation (Haq, Abdulabad, Asghar, & Szabo, 2023). The same types of local contraction through hunting pressure had been mentioned in Punjab. Community based regulation has been highlighted as one of the possible effective methods to slowdown the hunting intensity in South Asia, and the options apply to Khairpur (Dolman et al., 2021).

The destruction of habitats also increases population reduction (Wong et al., 2024). The depletion in the avian population has been attributed to wetland loss and expansion of irrigation in Sindh, anthropogenic activities in the coastal landscape. Habitat fragmentation has also been caused by the agricultural intensification and land use change, which have impacted the population of the francolin. The effect of farming on bird populations in Sindh has been widely reported, which in turn shows the importance of sustainable land management. (Sagar et al., 2023)

Ecological specialization predisposes the Black Francolin in a negative way (Hasui et al., 2024). Its dependency on riverine strips and planted fields resembles the results of desert margins of Sindh, where species-specific birds are more endangered during the habitat alteration (Ónodi, Czeglédi, & Erős, 2024). Further

emphasis on the conservation of game birds in damaged habitats is further provided by localized surveys in Khairpur District. Francolins are also regarded as a species of concern by global conservation surveys, and it is important to address them regionally (Hernández-Navarro et al., 2024).

The results of this research hence justify the use of integrated conservation measures. The resilience of the Grey Francolin indicates that the sustainability of the species can be marked by the management of the habitat and controlled hunting. The weakness of Black Francolin, however, needs specific measures to alleviate it such as restoration of habitats in riverine belts and the tightening of hunting regulations. The concept of community based conservation continues to form a foundation of efficient management of biodiversity in South Asia. This work provides the baseline information of avian conservation in Sindh and in a wider ecological and conservation setting, creating a way forward towards sustainable management of biodiversity in Pakistan.

## CONCLUSION

The present study provides essential baseline information on the population status, habitat distribution and key threats affecting Black (*Francolinus francolinus*) and Grey (*Francolinus pondicerianus*) in Nara District, Khairpur, Sindh. The findings indicate that Grey Francolin populations remain relatively stable and well-adapted to semi-arid agricultural landscapes and scrubland habitats, reflecting ecological resilience and adaptability to fragmented environments. In contrast, Black Francolin populations show a noticeable decline and are largely confined to irrigated vegetation zones and riverine areas, highlighting their vulnerability to habitat degradation, human disturbance, and illegal hunting. Statistical analyses further revealed significant differences in habitat preferences between the two species, emphasizing species specific ecological requirements and exposure to distinct threats. These outcomes point to the urgent need for integrated conservation strategies, including habitat restoration, stricter enforcement of hunting regulations, and the promotions of community-based wildlife management initiatives. Overall, this research contributes valuable local-scale ecological insights that can support broader biodiversity conservation planning and sustainable wildlife management efforts in Pakistan.

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