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**DISTRIBUTION AND HABITAT SELECTION OF GREY FRANCOLIN
(FRANCOLINUS PONDICERIANUS) IN SWEGALI GAME RESERVE DISTRICT
SWAT, KHYBER PAKHTUNKHWA, PAKISTAN**

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ABSTRACT

Animals use some habitats and quit others. It is essential to examine resource which is of great interest to the animal for its survival. Distribution and habitat selection of Grey Francolin was examined in Swegali game reserve during June 2007. Twelve line transects 200 meters wide and average 3.73 kilometers long were laid down randomly for collection of data from 06h00-20h00 and observed 58 Grey francolins singly or in pairs. Distributed of Grey francolin was observed in three of the available six habitat types including woody ravines, shrub land and agricultural fields. Chi-squared test showed that Grey francolin displayed significant habitat selection and highly significant preference for woody ravines, northerly aspects and foraged in the morning and evening, a slight drag to the afternoon was also observed. The study can contribute to planning of management interventions for the study species and its preferred habitats. It might assist policy makers to devise policies pertaining to agriculture, study species and their habitats to mitigate encroachment into marginal lands for agriculture, human settlements, use of pesticides and unregulated hunting, assessment of the effects of resource use on wild populations, planning and policy decisions for habitat management and harvest levels.

Keywords: Distribution, habitat selection, Grey francolin, Swegali Game Reserve.

INTRODUCTION

Animal ecology focuses on use of environment, including food and habitat by an animal species (Johnson, 1980). Animals use some habitats more frequently and stay away from others (Krebs, 1999). Availability of suitable habitat is essential for proper nourishing of animal population. It is critical to examine the resources that are more important for survival of a species (Manly et al., 1993). Grey Francolin is widely distributed. The main causes for decline of the population of Grey francolin include conversion of habitats into agricultural lands, human settlements, mechanized farming adaptations, use of pesticides and unmanaged hunting. However, the true

reasons of its population decline are uninvestigated (Khan, 1999).

Grey Francolin (GH: *Francolinus pondicerianus*; family Pheasianidae, order Galliformes, Aves) is omnivorous (Chaudhry and Bhatti, 1992) consuming leaves, shoots, flowers, fruits, tubers, seeds and root, eggs, larvae, insects and worms (Robert, 1991; Johnsgard, 1999; Madge and McGowan, 2002). GH roosts on lower branches of trees and shrubs during night (Roberts, 1991)

GH are found in dry habitat, including dry to semi-deserts grasslands and scrub, and associated cultivation land up to 600 m (asl) and nonexistent in extreme desert and infrequent up to 1,400 m asl (Roberts, 1991). This species has a large range between 1,000,000-10,000,000

km² (Del Hoyo et al., 1994). Grey francolin was estimated to be of Least Concern on IUCN Red List (Bird Life International, 2015).

The present study was conducted to examine habitat selection of Grey francolin in Swegali game reserve district Swat Khyber Pakhtunkhwa Pakistan in June, 2007. This study will help conservation organizations in managing habitats of Grey francolin.

MATERIALS AND METHOD

Study Area

Swegali Game Reserve (34°46'30" -34°43'0" N, 72°12'0" -72°15'30" E; District Swat, Khyber Pakhtunkhwa, Pakistan; 1,000- 1,600 m asl; 2,645 ha; established October 1984), is bounded by a ridge in the north, separating it from the watershed of Kotlai sub-stream, ridge separating the watershed of village Parrai sub-stream in the south, Dadahara and Gaddo villages in the east and ridge separating the watershed of Jolgaran sub-stream (Figure 1).

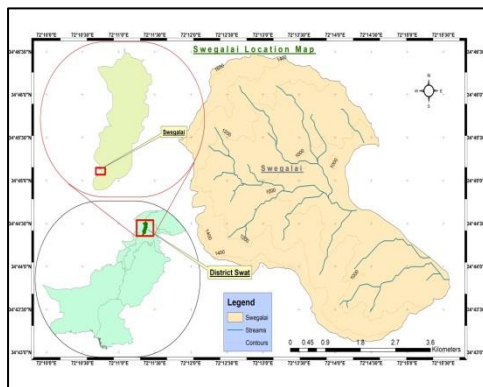


Figure 1: Map location map of Swegali Game Reserve

Major game species of the reserve include Grey Francolin, Black Francolin (*Francolinus francolinus*) and Chukar Partridge (*Alectoris chukar*). Among raptors, Lesser Kestrel (*Falco naumanni*) and Shikra (*Accipiter badius*) are present. Asiatic jackal (*Canis aureus*), Indian hare (*Lepus nigricollis*) and Indian crested

porcupine (*Hystrix indica*) are prominent mammal species in the reserve (Kakakhel, 2020).

The reserve has rich plant biodiversity: 19 key dicot species belong to 15 families (Apocynaceae: *Nerium oleander*, Asclpiadaceae: *Periploca aphylla*; Anacardiaceae: *Rhus cotinus*; Acanthaceae: *Justica adhatoda*, *J. adhatoda*; Liniaceae: *Ajuga parviflora*; Lamiaceae: *Teucrium stocksianum*, *Otostegia limbata*, *O. limbata*;; Moraceae: *Ficus palmate*; Myrtaceae: *Myrtus communis*; Oleaceae: *Olea ferrugine*), Polygonaceae: *Rumax hastatus*; Papilionaceae: *Indigofera heterantha*; Plumbaginaceae: *Limonium gelsii*; Phamnaceae: *Zizyphus oxyphylla*, *Z. oxyphylla*; Rosaceae: *Cotoneaster microphyllus*, *Rubus fruticosus*; Sapindaceae: *Dodonea viscosa*; Ulmaceae: *Celtis australis*; and Vitaceae: *Vitis jacquemontii* and 9 species of grasses (family Poaceae: *Aristida cynantha*, *A. mutabilis*, *Cynodon dactylon*, *Dactyloctenium glumerata*, *D. aegyptium*, *Apluda mutica*, *Hetropogan contortus*, *Imperata Cylindrica* and *Sorghum halpense*) (Kakakhel, 2020).

Methodology

Study area was sampled by walking through 12 variable length (2.02 - 5.43 km: Mean 3.73 km \pm 1.063, SD)) with constant width (200 m) belt transects (Table 1, Figure 2) laid randomly between 0600 and 2000 hr by 36 observers with 12 trained pointer dogs flushing for covering an area of 8.954 km². Each transect was searched by three observers and one trained pointer dog on the same day. It was presumed that all Grey Francolin had equal chances of being sighted (Bibby et al., 1992; Kakakhel, 2020). Habitat type (agricultural fields, shrub land, barren rocks, woody ravines, grasslands and mountain slopes), aspect and distance to nearest water source (springs or rain fed pool) were recorded for each sighted Francolin's vegetation

characteristics (Kakakhel, 2020). Number of the male and female Francolins flushed were recorded during transect sampling. Statistical analysis was carried through Chi square test (Holmes et al., 2006). Survey reports for ten years (2010 to 2019) on Grey Francolin were reviewed from record of the Khyber Pakhtunkhwa Wildlife Department (Table 2)

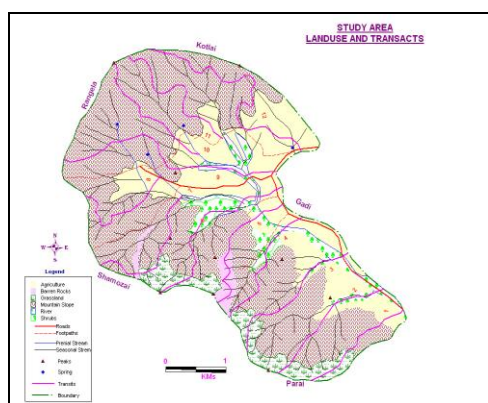


Figure 2: Transects tracts (pink lines) and habitat type distribution of the study area

Statistical Analysis

Mean and standard deviation were calculated using conventional methods, while significance of difference was judged at a 0.05 level using chi-square test (Holmes et al., 2006). The area surveyed was 8.954 km².

RESULTS

Table 2 reveals that 58 Grey Francolins were observed singly, in pairs and family groups in the study area. Out of the total Grey francolin the males were 27 and females were 31.

Table 3 shows the population of Grey francolin recorded in the study area during 2010 to 2019. The population varied during the period. The dominant year was 2014 with 85 Grey francolins. The second dominant year was 2012 with 82 Grey

francolins while in the remaining years the population fluctuated between 3-76.

Table 1: Number of transects traversed and area covered in the study area.

Transect No.	Transect length (km)	Area (km ²)
1	5.43	1.09
2	4.36	0.872
3	4.74	0.948
4	3.10	0.610
5	4.89	0.978
6	3.07	0.614
7	3.65	0.730
8	2.02	0.404
9	3.99	0.798
10	4.12	0.824
11	3.32	0.664
12	2.11	0.422
Total	44.8	8.954

Table 2: Number of Grey francolin in the study area

Year	Male	Female	Total
2007	27	31	58

Table 3: Review of survey report on Grey francolin in the study area

Year	Grey francolin
2010	3
2011	15
2012	82
2013	76
2014	85
2015	65
2016	18
2017	29
2018	23
2019	32

Aspects

Table 4 shows the use of different aspects by the target species, four main aspects (northerly, southerly, easterly and westerly) were assessed for percent preferences by Grey francolin. Northerly aspects (including north-eastern and northwestern) were preferred by Grey francolin (91%) due to the reason that Grey partridge may prefers denser shrub/ tall grass vegetation and Northern slops normally have lowered vegetative covers. And western (9%) while preferences on South, South East, South West and East aspects of habitats remained zero.

Habitat Utilization

Table 5 revealed that Grey francolin used habitats in relation to its availability.

Table 4: Grey francolins recorded on different aspects in the study area

Aspect	Grey francolin (n =58)	
	Observed	%
North	19	32
North East	16	28
North West	18	31
South	00	00
South East	00	00
South West	00	00
East	00	00
West	05	9

Among six habitat types Grey francolin selected three including agricultural fields, woody ravines and shrub lands. The percent selection of habitat was highest in woody ravines (46 %) followed by agricultural fields (28 %) and Shrub lands (26 %). Also, use of percent area remained high in woody ravines (17 %), agriculture fields (15 %) and shrub lands (15%) respectively. More frequent in woody ravines (usually associated with thicker shrub cover in ravine; no population in low grasses. Mountain slopes and barren rocks due to no camouflage.

The data showed that Grey francolins prefer/select some habitats and avoid others. The Chi-squared test showed the use of three out of six habitats by Grey francolin in relation to its availability significantly ($\chi^2= 74.45, p=<0.001$). Grey francolin ($\chi^2= 38.49, p= <0.001$) showed highly significant preference for woody ravines.

Table 5: Percent use of Grey francolins in various habitat types of the study area

Habitats Type	Area (Ha)	% area	Grey francolin	
			Observed	% Birds
Agric: field	450	17	16	28
Woody ravines	405	15	27	46
Shrub lands	395	15	15	26
Mountain slopes	715	27	00	00
Grass lands	360	14	00	00
Barren rocks	320	12	00	00
Total	2645	100	58	100

Proximity to Water Sources

The proximity of Grey francolin to nearest water source (rain-fed pool or springs) was also calculated. These distances were classified to five distance classes (Table 6). The highest percentage (55 %) of Grey francolin was observed

Table 6: Grey francolin to water sources in the study area

Distance (m)	Grey francolin	
	Number	%
0-25	00	00
25-50	6	10
50-75	13	23
75-100	32	55
>100	7	12

Table 7: Grey francolins observed through the day in Swegali Game Reserve

Sighting time of birds	Grey francolin (n=58)	
	Observed	%
06h00-08h00	18	30
08h00-10h00	9	16
10h00-12h00	11	19
12h00-14h00	8	14
14h00-16h00	5	9
16h00-18h00	4	7
18h00-20h00	3	5
Total	58	100

at a distance of 75-100 meters to the water source followed by 23 % of Grey francolin with proximity to water source as 50-75

meter, 10 % at 25-50 m and 12 % at more than 100 m.

Sighting Time

Grey francolin was observed throughout the day but highest percentage (46%) was recorded in the morning between 06h00 and 10h00. The percent Grey francolin recorded in the noon between 10h00-12h00 was 19 %, in the afternoon 12h00-16h00 the percentage was recorded as 23% and in the evening the percentage 16h00-20h00 was observed as 12 % (Table 7).

DISCUSSION

The agricultural fields lying adjacent to the mountain are rain-fed, rainfall is very critical in Sewagali Game Reserve, wheat is raised and is harvested till the end of May, and thus, these fields remain barren till the next sowing season in November, each field has shrubby vegetation on its boundary. During crop harvest, the wheat grains that have fallen in the fields are available for birds as feed. Grey francolins use these agriculture fields.

The results showed that Grey francolins displayed a significant degree of habitat selection. They used cover habitats and showed a significant preference for woody ravines. They used three out of the six habitats, completely avoiding the mountain slopes, barren rocks, and grass lands. However, once the distance from water is examined, some differences emerge. Proximity of 10 to 55 % of Grey francolin to water sources remained in the range of 25 -100 m, out of 12 % were found at more than 100 m. These findings on habitat selection are in general agreement with those reported by Roberts, 1991; Khan, 1999; Madge et al., 2002; Sibley et al., 1990; Walter, 2000; Christensen, 1996).

Grey francolin was recorded most frequently on the northerly aspects (91%). This can be straightforwardly explained by

several factors: reduced solar radiation results in cooler conditions, reduced heat stress in summer; increased moisture on northerly slopes promotes better vegetation growth and foraging conditions; The birds will seek to minimize the effects of heat stress by foraging early morning/evening as above and on shaded aspects.

More than 2/3rd population of Grey francolin was sighted foraging in the morning and evening, however, showed a slight drag towards mid-afternoon. The maximum temperature of the study area registered during the field work was 35°C in the mid-afternoon so this behaviour is also clearly connected with the need to reduce heat stress. The maximum number of Grey francolin in pairs or in family group of five birds. This shows Grey francolins were in family parties. These findings conform broadly to those of Johnsgard, (1999); Roselaar, (1995); Madge and McGowan, (2002) that Some Galliformes are solitary while others spend some part of the year in mated pairs or in flocks.

CONCLUSION

Grey francolins prefer woody ravines and habitats that are comparatively dry. Grey francolin prefer northerly aspects and foraging in the morning and evening to reduce heat stress in summer, Grey francolin of five birds might be an anti-predator strategy to forage in groups. The study could attract natural resource managers to plan conservation interventions for the study species in the preferred habitats and might be magnetize the policy makers to devise policies pertaining to agriculture, study species and their habitats to mitigate encroachment into marginal lands for agriculture, human settlements in the species habitats, the use of mechanized farming, pesticides and unregulated hunting beside contributing to species habitat improvement practices. Further studies are needed to investigate

aspects preferences and foraging time of the study species in winter so that management interventions could be planned accordingly. The results of this study can contribute to studies on population dynamics of the study species; modeling and projecting the impact of habitat change on species population; identifying key areas for protection; assessment of the effects of resource use like livestock grazing, grass cutting on wild populations, planning and policy decisions for habitat management and harvest levels.

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