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SEASONAL VARIATION IN THE POPULATION AND SPATIAL DISTRIBUTION OF THE BLACK DRONGO DICRURUS MACROCERCUS IN AND AROUND TAL CHHAPAR WILDLIFE SANCTUARY, RAJASTHAN, INDIA

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Abstract
Seasonal changes in the abundance, distribution and age structure of the Black Drongo Dicrurus macrocercus were studied in Tal Chhapar Wildlife Sanctuary and the adjoining farmland in the Thar Desert, Rajasthan, during 2024–2025. Twelve fixed-radius (50 m, 20 min) point-count stations in grassland, saline flat and agro-ecosystem were counted in winter, summer and monsoon, and occurrence was mapped along three walking routes (22.6 km; 64 sighting events). Counts were lowest in summer (2.17 ± 1.34 birds per point), intermediate in winter (3.17 ± 1.85) and highest in the monsoon (4.92 ± 2.43) (Friedman $\chi2$ = 20.18, P < 0.001). Habitat had a strong effect (two-way ANOVA $F_{2,27}$ = 48.26, P < 0.001): counts in the agro-ecosystem and grassland were 5.7 and 4.1 times those on the saline flat, with no season × habitat interaction. Adult numbers did not differ among seasons ($\chi2$ = 3.31, P = 0.191); the monsoon peak resulted from recruitment, with juveniles forming 32.2 % of birds in point counts and 40.7 % on routes. Flock size was smallest in summer (1.75), when territorial pairs predominated, and largest in the monsoon (3.52), when family parties formed (Kruskal–Wallis H = 17.72, P < 0.001). Distribution was governed mainly by the availability of elevated perches such as wires and bund trees. The local population is stable and breeding successfully, but it depends on a tree- and perch-rich agricultural landscape around the sanctuary.

Keywords: *Black Drongo, point count, seasonal abundance, recruitment, perch availability, agro-ecosystem, Thar Desert*

1. Introduction

Seasonal change in population size is a basic measure of the ecological status of a species. In resident birds it reflects the balance of survival, reproduction and local movement, which are in turn shaped by food supply, climate and habitat structure (Lack, 1954; Newton, 1998). The Black Drongo Dicrurus macrocercus Vieillot, 1817 is an insectivorous passerine widely described as a common resident of open country, cultivation and roadside wires in the Indian subcontinent (Ali and Ripley, 1987; Grimmett et al., 2011; Rasmussen and Anderton, 2012). It is valued as a natural enemy of crop pests (Dhindsa and Saini, 1994) and is listed as Least Concern globally (BirdLife International, 2016).

Earlier work on the species in South Asia has examined perching (Jaman et al., 1999), foraging (Narayana et al., 2014; Kaur and Kler, 2018a), habitat preference (Nath et al., 2016) and breeding (Asokan et al., 2010; Kaur and Kler, 2018b). Quantitative data on seasonal abundance are, however, scarce for the arid north-west of India, and none exist for Tal Chhapar. The present study therefore aimed (i) to estimate the abundance of the Black Drongo in three seasons and three habitats, (ii) to map its spatial distribution, (iii) to describe the age composition of the population and (iv) to relate the seasonal pattern to temperature, food availability and breeding. The null hypothesis tested was that abundance and distribution do not differ among seasons or habitats.

Material and Methods

Study area

Tal Chhapar Wildlife Sanctuary (27°50′ N, 74°25′ E) lies in Churu district in the north-western arid zone of Rajasthan. It is a flat saline depression (tal) covered mainly by open grassland of sewan Lasiurus sindicus and dhaman Cenchrus ciliaris with scattered Prosopis and Acacia trees, and it is best known as a refuge of the Blackbuck Antilope cervicapra. The sanctuary is surrounded by farmland growing mustard, wheat and gram in winter and pearl millet (bajra), cluster bean (guar) and moth bean in the monsoon, with neem Azadirachta indica, khejri Prosopis cineraria and ber Ziziphus mauritiana on field bunds. Three seasons are recognised: winter (October–February), summer (March–June) and monsoon (July–September).

Field methods

Twelve permanent point-count stations were established: five in sanctuary grassland (GL), three on the saline flat (SF) and four in the adjoining agro-ecosystem (AG). Each station was counted once per season (01 December 2024, 15 May 2025 and 21 August 2025) by a single observer, with a fixed radius of 50 m and a count period of 20 min (Hutto et al., 1986; Bibby et al., 2000; Javed and Kaul, 2002). For every bird the age class (adult or juvenile), behaviour (perched or flying) and detection distance were noted. Occurrence was mapped along a grassland route (T1, 3.2 km) and an agro-ecosystem route (T3, 3.8 km) in all seasons, and along a saline-flat edge route (T2, 1.6 km) in the monsoon, when the tal holds water. For each sighting the location (GPS), habitat, flock size, age composition, perch type and distance to water were recorded. Juveniles were identified by dull plumage, pale-tipped wing coverts and a short tail fork; adults could not be sexed because the species is sexually monomorphic in plumage.

Data analysis

Counts were summarised as totals and means (± SD) per point. Local density was expressed as birds per hectare of count circle (mean count ÷ 0.785 ha). Because the same stations were revisited, seasonal differences were tested with the Friedman test and pairwise Wilcoxon signed-rank tests; the joint effect of season and habitat was tested with a two-way ANOVA and checked with a Poisson generalised linear model (log link) (Zar, 2010). Encounter rate on routes was expressed as birds km-1, and flock sizes were compared with Kruskal–Wallis and Mann–Whitney U tests. Counts are treated as indices of relative abundance, since detection probability was not modelled (Buckland et al., 2001; Johnson, 2008). Significance was accepted at $P < 0.05$.

Results

Abundance across seasons and habitats

A total of 123 birds were counted in 36 station visits. Numbers were lowest in summer (26 birds), intermediate in winter (38) and highest in the monsoon (59), giving local densities of 2.76, 4.03 and 6.26 birds ha-1 of count circle (Table 1; Fig. 1). The species occupied 11, 10 and 12 of the 12 stations respectively; all empty stations were on the saline flat. Seasonal differences were significant (Friedman $\chi2 = 20.18$, d.f. = 2, $P < 0.001$), and all pairwise contrasts differed (winter vs summer $P = 0.018$; winter vs monsoon $P = 0.002$; summer vs monsoon $P < 0.001$). The two-way ANOVA showed strong effects of season ($F2,27 = 24.57$, $P < 0.001$) and habitat ($F2,27 = 48.26$, $P < 0.001$) and no interaction ($F4,27 = 1.41$, $P = 0.256$). In the Poisson model, monsoon counts were 2.27 times summer counts (95 % CI 1.43–3.60), and counts in the agro-ecosystem and grassland were 5.72 (2.74–11.95) and 4.05 (1.93–8.51) times those on the saline flat.

Table 1. Point-count results for the Black Drongo in three habitats and seasons at Tal Chhapar (50-m radius, 20-min counts).

Habitat (points)	Winter mean ± SD	Summer mean ± SD	Monsoon mean ± SD	Total birds
Grassland (5)	3.20 ± 0.84	2.40 ± 0.55	5.20 ± 1.48	54
Saline flat (3)	0.67 ± 0.58	0.33 ± 0.58	1.67 ± 1.15	8
Agro-ecosystem (4)	5.00 ± 0.82	3.25 ± 0.96	7.00 ± 1.15	61
All points (12)	3.17 ± 1.85	2.17 ± 1.34	4.92 ± 2.43	123
Total birds	38	26	59	123
Density (birds ha-1; 95 % CI)	4.03 (2.53–5.53)	2.76 (1.68–3.84)	6.26 (4.29–8.23)	—
Stations occupied	11/12	10/12	12/12	—
Density refers to the area within count circles (0.785 ha per point) and should not be extrapolated to the whole landscape.				

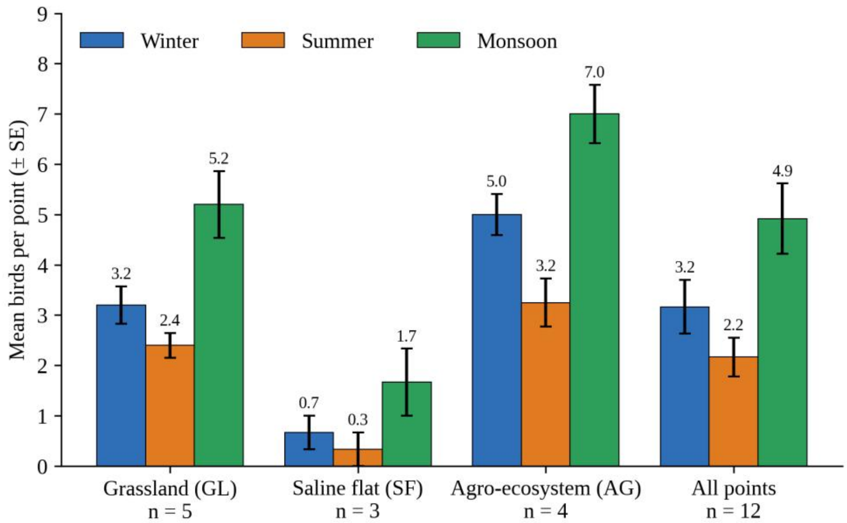

Fig. 1. Mean number of Black Drongos per point (± SE) in three habitats and three seasons at Tal Chhapar.

When age classes were separated, adult totals were 38 (winter), 26 (summer) and 40 (monsoon) and did not differ significantly ($\chi2 = 3.31$, d.f. = 2, $P = 0.191$). The proportion of birds seen perched (≈ 79 %) was the same in all seasons ($\chi2 = 0.08$, $P = 0.960$), and mean detection distance varied little (21.3–23.5 m), so the seasonal change in counts was not caused by a change in detectability. Detection distances were greatest on the open saline flat (33.2 ± 6.3 m, vs 17.9 ± 8.5 m in the agro-ecosystem; Kruskal–Wallis H = 11.56, P = 0.003), confirming that low saline-flat counts reflect genuine scarcity.

Spatial distribution, encounter rate and flock size

Black Drongos were concentrated along the bunds, wires and bund trees of the agro-ecosystem and in grassland with scattered trees; the open saline flat was used sparsely (Fig. 2). Of 163 birds recorded on routes, 39.3 % were in the agro-ecosystem, 36.2 % in grassland, 14.1 % at the settlement edge, 6.7 % in scrub and 3.7 % on the saline flat. Encounter rates on T1 were 5.9, 5.3 and 10.6 birds km-1 in winter, summer and monsoon, and on T3 7.4, 4.7 and 10.8 birds km-1; on T2 the monsoon rate was 3.8 birds km-1. The number of groups per kilometre changed little (2.6–3.1 on T1 and T3), so the monsoon increase came from larger groups rather than more groups. Flock size was not correlated with distance to water (Spearman rs = −0.20, P = 0.105). On the agro-ecosystem route, 47 % of sighting events were of birds on wires.

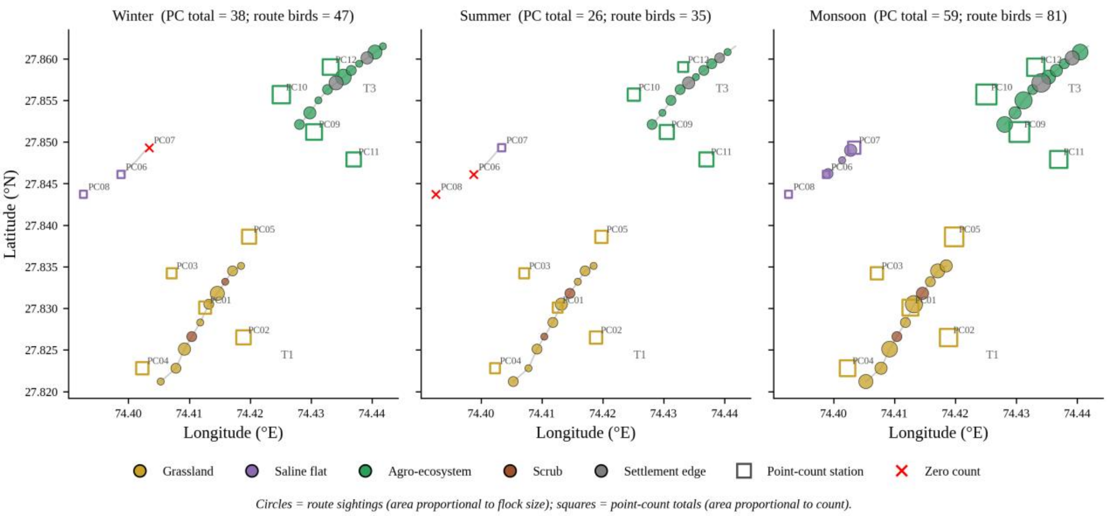

Fig. 2. Occurrence maps of the Black Drongo in three seasons. Squares are point-count stations (area proportional to count); circles are route sightings (area proportional to flock size); red crosses are zero counts.

Flock size differed among seasons (Kruskal–Wallis H = 17.72, d.f. = 2, P < 0.001; Table 2). In summer, 90 % of sightings were singles or pairs and no group exceeded three birds; in the monsoon, 43.5 % of sightings were groups of four to seven, mostly family parties. Monsoon groups were larger than those of winter (U = 125, P = 0.005) and summer (U = 67.5, P < 0.001), whereas winter and summer did not differ (U = 249, P = 0.283). In summer, 30 % of route sightings involved nesting activity.

Table 2. Encounter rate, flock size and age composition of the Black Drongo on mapping routes.

Parameter	Winter	Summer	Monsoon
Distance walked (km)	7.0	7.0	8.6
Sighting events / birds	21 / 47	20 / 35	23 / 81
Encounter rate (birds km-1)	6.7	5.0	9.4
Mean flock size ± SD (range)	2.24 ± 1.22 (1–5)	1.75 ± 0.64 (1–3)	3.52 ± 1.56 (1–7)
Singles / pairs (% of sightings)	33.3 / 33.3	35.0 / 55.0	4.3 / 26.1
Immature birds (JV + FL)	0	0	33 (40.7 %)
Immatures per adult	0	0	0.69

Age composition

No juveniles were recorded in winter or summer. In the monsoon, juveniles made up 19 of 59 birds in point counts (32.2 %; 0.48 per adult) and immatures 33 of 81 birds on routes (40.7 %), including four dependent fledglings (Fig. 3). The juvenile share was highest in grassland (38.5 %), followed by the agro-ecosystem (28.6 %) and saline flat (20.0 %). Juvenile and adult numbers at stations were positively correlated (rs = 0.69, n = 12, P = 0.014), reflecting family groups.

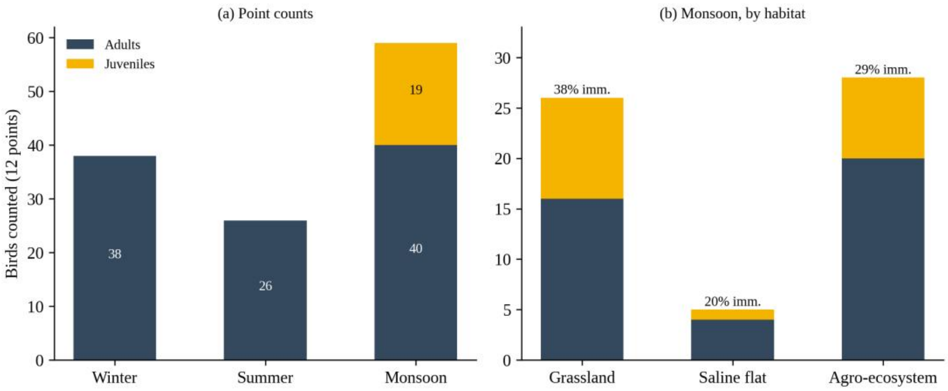

Fig. 3. Age composition of the Black Drongo. (a) Adults and juveniles in point counts by season; (b) monsoon point counts by habitat with the percentage of immatures.

Discussion

The study shows a clear seasonal cycle in the Black Drongo population at Tal Chhapar, with a summer minimum and a monsoon maximum. The most important finding is that this cycle was produced mainly by recruitment rather than by movement of adults: the number of adults was statistically constant through the year, and the monsoon peak consisted of locally produced young. This agrees with the status of the species as a sedentary resident in north-western India (Ali and Ripley, 1987). The observed juvenile-to-adult ratio (≈ 0.5) corresponds to roughly one surviving young per pair in late August, which suggests moderate breeding success, comparable with the 64.7 % fledging success reported from northern Pakistan (Awais and Bibi, 2014).

The summer decline in counts coincided with the breeding season, when nest building and chick feeding were recorded. Breeding drongos are strongly territorial (Luxin, 1989), so pairs are spaced out and one bird is often at the nest outside the count circle. High temperatures (29 °C at the start of counts and above 38 °C by mid-morning) also reduce bird activity and conspicuousness (Robbins, 1981; du Plessis et al., 2012). Since detection distance and the proportion of flying birds did not change, the summer low is best interpreted as a combination of territorial spacing and reduced availability for counting, rather than a true loss of birds. The timing of breeding, with young fledging at the onset of the monsoon insect flush, fits the breeding season of May to August reported elsewhere in India (Asokan et al., 2010; Kaur and Kler, 2018b) and the principle that birds time reproduction to coincide with peak food supply (Lack, 1954).

Habitat had an even stronger effect than season. Counts in the perch-rich agro-ecosystem and grassland were four to six times those on the treeless saline flat, and the same seasonal pattern occurred in all habitats. As a sit-and-wait predator that sallies from elevated perches (Remsen and Robinson, 1990), the Black Drongo depends on wires, posts and trees. Narayana et al. (2014) similarly concluded that habitat selection by this species is governed by perch availability and height, and the high use of wires in farmland (47 % of sightings) is close to the 57.8 % recorded in Bangladesh (Jaman et al., 1999). Vegetation structure is a principal determinant of bird distribution in open grassland and steppe systems (Rotenberry and Wiens, 1980), and the present results extend this to an arid-zone insectivore. The abundance of drongos in crop fields also agrees with surveys of agricultural bird communities in western India (Abdar, 2014; Borad and Parasharya, 2018).

These results have implications for conservation. The local population appears secure: it occupied almost all stations, the adult pool was stable and breeding was successful. However, the core habitat of the sanctuary, the saline flat, supports very few drongos, and most birds depend on the surrounding farmland. The retention of bund trees and perches, and restraint in insecticide use, which has been linked to declines of insectivorous farmland birds (Mineau and Whiteside, 2013;

Hallmann et al., 2014), are therefore important for this species. Landscape heterogeneity is a key support of farmland bird populations (Benton et al., 2003). The limitations of the study, namely single counts per season and the absence of detectability correction, mean that the densities should be treated as local indices; repeated counts and distance sampling over several years are recommended to confirm long-term trends (Buckland et al., 2001).

Conclusion

The Black Drongo is a common and stable resident at Tal Chhapar. Its numbers vary significantly with season, being lowest during summer breeding and highest after the monsoon when juveniles join the population, while the number of adults remains nearly constant. Its distribution is governed by the availability of elevated perches, which makes the agro-ecosystem and treed grassland its main habitats. Conservation of the species in this arid landscape depends on maintaining trees, perches and moderate pesticide use in the farmland around the sanctuary.

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