

Seasonal Diversity of Birds and Ecosystem Services in Agricultural Area of Western Ghats, Maharashtra State, India

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Abstract: Seasonal diversity of birds and ecosystem services in agricultural area was studied in 2009- 2012 by using line transect method. Maximum bird's species avoid agricultural area nearly one third of all observed birds regularly to occasionally use such habitat, often providing important ecosystem services like pest control, pollination and seed disposal. I compared bird's species that prefer agricultural area with respect to diet, habitat, rang and population size and resources specialization. The species richness and diversity was more in winter, especially Insectivores, frugivores, granivores and omnivores. In contrast, species richness and diversity less in rainy season. These finding indicate that winter is favorable for breeding, feeding and foraging for many omnivores, granivores, frugivores than other two season even agricultural area providing important ecosystem services.

Key words: Agricultural area, birds, diversity, Ecosystem services, Western Gjhats.

I. Introduction

The bird habitats of the Indian subcontinent can be roughly divided into forest, scrub, wetlands, grassland, desert and agricultural land. The forest areas of the region are vitally important for many birds. Relatively few birds are characteristics of scrub mixed with grassland. Wetlands are abundant in the region and support rich array of waterfowl. They are major staging and wintering ground for waterfowl. Agriculture birds constitute an important component. The dual role of bird in agriculture is very well known (Ali 1971).Agriculture provides a concentrated and highly predictable source of food to bird. This food includes grains, seeds, fruits, green vegetation of crop plants, Insects, rodents and arthropods ('O'Cannor and Shrub 1986).Agricultural land scapes in Maharashtra, especially in the intensively cultivated area like South Maharashtra have number of dairy and poultry farms interspersed among crop field. These farms along with a variety of agroforstry trees provide additional food to birds in the form of animal feeds, tree- fruits, seeds, nectar etc.Birds of agricultural area therefore include granivores, frugivores, insectivores and omnivores. Although less than 1% of the world's birds species primarily prefer agricultural area. Nearly a third of all birds species occasionally use such habitats (Sekercioglu et al.,2007), often providing important ecosystem services, such as pest control, pollination, seed dispersal (Sekercioglu 2006). Agriculture ornithology helps us to obtain scientific information on birds in relation to agriculture.This information useful to their management and conservation of useful species of birds and control of pest birds.There is growing interest in avian diversity in agricultural area such as Shindsa and Saini 1994, Wang *et al.*,2003,Naidoo R. 2004,Waltert *et al.*, 2005,Perfecto *et al.*, 2008,Tscharntke *et al.*, 2008, Van Bael *et al.*, 2008, Clough *et al.*, 2011, Sekercioglu 2012.

The objective of this study is

- To obtain scientific information on birds, whether it is useful or harmful for agriculture.
- To study in detail the food and feeding behavior.
- To study in their reproduction, roosting and population dynamics.

II. Material and Methods

Some of the basic methods used in this study as described by Bibby *et al.* (1992) are: **Point counts:** to determine abundance by undertaking a bird count from a fixed location for fixed period of time. The bird species seen or heard are recorded.

Line transect: suitable for estimating density and abundance which involves moving along a fixed route (transect) and recording the bird species seen and heard on both side of the transect.

The study was conducted in between September 2009 to August 2012. The bird counts were carried out in the morning between 7.00 am to 10.00 am.and evening between 4.00 pm to 6.00 pm 10 by 40 Olympus binocular was used to confirm the identification of the birds, nests located by sight. **Data analysis:**

- a. Species composition: abundance for each species was calculated by summing up the number of individuals recorded in all the transect.
- b. Species diversity using Simpson index (D), Simpson Diversity index (1-D) and Simpsons Reciprocal index (1/D)

III. Result and Discussion

Table 1. Birds observed in agricultural area of Western Ghats, Maharashtra 2009-2012

1.	Intermediate Egret <i>Mesophoyx intermedia</i>
2.	Little Egret <i>Egretta garzatta</i>
3.	Cattle Egret <i>Bubulcus ibis</i>
4.	Little Heron <i>Butorides striatus</i>
5.	Darter <i>Anbinga melanogaster</i>
6.	Indian Cormorant <i>Phalacrocorax fuscicollis</i>
7.	Grey Heron <i>Ardea cinerea</i>
8.	Woolly-necked Stork <i>Ciconia episcopus</i>
9.	Black Ibis <i>Pseudibis papillosa</i>
10.	Black-shouldered Kite <i>Elanus caeruleus</i>
11.	Black Kite <i>Milvus migrans</i>
12.	Shikra <i>Accipiter badius</i>
13.	Pallid Harrier <i>Circus macrourus</i>
14.	Jungle Bush Quail <i>Perdica asiatica</i>
15.	Yellow-legged Buttonquail <i>Turnix tanki</i>
16.	Indian Peafowl <i>Pavo cristatus</i>
17.	Demoiselle Crane <i>Grus virgo</i>
18.	White-breasted Waterhen <i>Amaurornis phoenicurus</i>
19.	Purple Swamphen <i>Porphyrio porphyrio</i>
20.	Black-winged Stilt <i>Himantopus himantopus</i>
21.	Indian Courser <i>Cursorius coromandelicus</i>
22.	Red-wattled Lapwing <i>Vanellus indicus</i>
23.	Common Sandpiper <i>Actitis hypoleucos</i>
24.	Little Stint <i>Calidris minuta</i>
25.	Little Ringed Plover <i>Charadrius dubius</i>
26.	River Tern <i>Sterna aurantia</i>
27.	Eurasian Collared Dove <i>Streptopelia decaocto</i>
28.	Spotted Dove <i>Streptopelia chinensis</i>
29.	Rock Pigeon <i>Columba livia</i>
30.	Rose-ringed Parakeet <i>Psittacula krameri</i>
31.	Common Hawk Cuckoo <i>Hierococcyx varius</i>
32.	Asian Koel <i>Eudynamis scolopacea</i>
33.	Greater Coucal <i>Centropus sinensis</i>
34.	Barn Owl <i>Tyto alba</i>
35.	Asian Palm Swift <i>Cypsiurus balasiensis</i>
36.	Common Swift <i>Apus apus</i>
37.	House Swift <i>Apus affinis</i>
38.	Indian Roller <i>Coracias benghalensis</i>
39.	Pied Kingfisher <i>Ceryle rudis</i>
40.	Stork-billed Kingfisher <i>Halcyon pileata</i>
41.	White-throated Kingfisher <i>Halcyon smyrnensis</i>
42.	Common Kingfisher <i>Alcedo atthis</i>
43.	Green Bee-eater <i>Merops orientalis</i>
44.	Chestnut-headed Bee-eater <i>Merops leschenaulti</i>
45.	Coppersmith Barbet <i>Megalaima baemacephala</i>
46.	Common Hoopoe <i>Upupa epops</i>
47.	Indian Grey Hornbill <i>Ocyroceros birostris</i>
48.	Streak-throated Woodpecker <i>Picus xanthopygaeus</i>
49.	Yellow-crowned Woodpecker <i>Dendrocopos mabrattensis</i>
50.	Common Iora <i>Aegithina tiphia</i>
51.	Indian Bushlark <i>Mirafra erythroptera</i>
52.	Ashy-crowned Sparrow Lark <i>Eremopterix grisea</i>
53.	Oriental Skylark <i>Alauda gulgula</i>
54.	Crested Lark <i>Galerida deva</i>
55.	Wire-tailed Swallow <i>Hirundo rustica</i>
56.	Streak-throated Swallow <i>Hirundo fluvicola</i>
57.	Black Drongo <i>Dicrurus macrocercus</i>

58. Greater Racket-tailed Drongo *Dicrurus paradiseus*
59. White-billied Drongo *Dicrurus caerulescens*
60. Common Woodshrike *Tephrodornis pondicerianus*
61. Long-tailed Shrike *Lanius schach*
62. Bay-backed Shrike *Lanius vittatus*
63. Rosy Starling *Sturnus roseus*
64. Common Myna *Acridotheres tristis*
65. Jungle Myna *Acridotheres fuscus*
66. House Crow *Corvus splendens*
67. Large-billed Crow *Corvus macrohynchos*
68. Small Minivet *Pericrocotus cinnamomeus*
69. Red-vented Bulbul *Pycnonotus cafer*
70. Yellow-eyed Babbler *Chrysomma sinense*
71. Jungle Babbler *Turdoides striatus*
72. Large Grey Babbler *Turdoides malcolmi*
73. Common Babbler *Turdoides caudatus*
74. White-throated Fantail *Rhipidura albicollis*
75. Grey-breasted Prinia *Prinia hodgsonii*
76. Ashy Prinia *Prinia socialis*
77. Plain Prinia *Prinia inornata*
78. Jungle Prinia *Prinia sylvatica*
79. Common Tailorbird *Orthotomus sutorius*
80. Greenish Warbler *Phylloscopus trochiloides*
81. White-rumped Shama *Copsychus malabaricus*
82. Oriental Magpie Robin *Copsychus saularis*
83. Indian Robin *Saxicoloides fulicata*
84. Common Stonechat *Saxicola torquata*
85. Great Tit *Parus major*
86. Paddyfield Pipit *Anthus rufulus*
87. White-browed Wagtail *Motacilla maderaspatensis*
88. Grey Wagtail *Motacilla cinerea*
89. White Wagtail *Motacilla alba*
90. Yellow Wagtail *Motacilla flava*
91. Oriental White-eye *Zosterops palpebrosus*
92. Purple-rumped Sunbird *Nectarinia zeylonica*
93. Purple Sunbird *Nectarinia asiatica*
94. Indian Silverbill *Lonchura malabarica*
95. Scaly-breasted Munia *Lonchura punctulata*
96. House Sparrow *Passer domesticus*
97. Baya Weaver *Ploceus philippinus*
98. Crested Bunting *Melophus lathami*

Table 2. Birds in different habitats of Western Ghats, Maharashtra 2009-2012

Sr.No	Name of Bird	Forest habitat	Wetland habitat	Agricultural habitat
1	Intermediate Egret	-	√	-
2	Little Egret	--	√	-
3	Cattle Egret	-	√	-
4	Little Heron	-	√	-
5	Darter	-	√	-
6	Indian Cormorant	-	√	-
7	Grey Heron	-	√	-
8	Wooly-necked Stork	-	√	-
9	Black Ibis	-	√	-
10	Black-shouldered Kite	√	-	-
11	Black Kite	√	-	-
12	Shikra	√	-	-
13	Pallid Harrier	√	-	-
14	Jungle Bush Quill	√	-	√
15	Yellow -legged Buttonquail	-	-	√
16	Indian Peafowl	-	-	√
17	Demoiselle Crane	-	-	√
18	White-breasted Waterhen	-	√	-

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19	Purple Swamphen	-	√	-
20	Black-winged Stilt	-	√	-
21	Indian Courser	-	√	√
22	Red-wattled Lapwing	-	√	√
23	Common Sandpiper	-	√	-
24	Little Stint	-	√	-
25	Little Ringed Plover	-	√	-
26	River Tern	-	√	-
27	Eurasian Collared Dove	-	-	√
28	Spotted Dove	-	-	√
29	Rock Pigeon	-	-	√
30	Rose-ringed Parakeet	-	-	√
31	Common Hawk Cuckoo	-	-	√
32	Asian Koel	-	-	√
33	Greater Coucal	-	-	√
34	Barn Owl	√	-	-
35	Asian Palm Swift	-	-	√
36	Common Swift	-	-	√
37	House Swift	-	-	√
38	Indian Roller	-	-	√
39	Pied Kingfisher	-	√	-
40	Stork-billed Kingfisher	-	√	-
41	White-throated Kingfisher	-	√	-
42	Common Kingfisher	-	√	√
43	Green Bee-eater	-	-	√
44	Chestnut-headed Bee-eater	-	-	√
45	Coppersmith Barbet	-	-	√
46	Common Hoopoe	-	-	√
47	Indian Grey Hornbill	√	-	√
48	Streak-throated Woodpecker	√	-	√
49	Yellow-crowned Woodpecker	√	-	-
50	Common Iora	√	-	√
51	Indian Bushlark	√	-	-
52	Ashy-crowned Sparrow Lark	-	-	√
53	Oriental Skylark	-	-	√
54	Crested Lark	-	-	√
55	Wire-tailed Swallow	-	√	√
56	Streak-throated Swallow	-	√	√
57	Black Drongo	-	-	√
58	Greater Racket-tailed Drongo	-	-	√
59	White-billed Drongo	-	-	√
60	Common Woodshrike	-	-	√
61	Long-tailed Shrike	-	-	√
62	Rosy Starling	-	-	√
63	Common Myna	√	-	√
64	Jungle Myna	-	-	√
65	House Crow	-	-	√
66	Large-billed Crow	√	-	√
67	Small Minivet	-	-	√
68	Red-vented Bulbul	-	-	√
69	Yellow-eyed Babbler	-	-	√
70	Jungle Babbler	√	-	√
71	Large Grey Babbler	-	-	√
72	Common Babbler	-	-	√
73	White-throated Fantail	-	-	√
74	Grey-breasted Prinia	√	-	√
75	Ashy Prinia	√	-	√
76	Plain Prinia	√	-	√
77	Jungle Prinia	√	-	√
78	Common Tailorbird	-	-	√
79	Greenish Warbler	-	-	√
80	White-rumped Shama	-	-	√
81	Oriental Magpie Robin	-	-	√
82	Indian Robin	-	-	√
83	Common Stonechat	-	-	√
84	Great Tit	-	-	√
85	Paddyfield Pipit	-	-	√
86	White-browed Wagtail	-	√	-
87	Grey Wagtail	-	√	√
88	White Wagtail	-	√	√

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89	Yellow Wagtail	-	√	√
90	Oriental White-eye	-	-	√
91	Purple-rumped Sunbird	-	-	√
92	Purple Sunbird	-	-	√
93	Indian Silverbill	-	-	√
94	Scaly-breasted Munia	-	-	√
95	House Sparrow	-	-	√
96	Baya Weaver	-	-	√
97	Crested Bunting	√	-	-

Table 3. Seasonal diversity of Birds in Agricultural Area of Western Ghats, Maharashtra 2009-2012

Sr.No	Name of Bird	Winter Season	Summer Season	Rainy Season
1	Yellow –legged Buttonquail	25	10	3
2	Indian Peafowl	5	5	-
3	Demoiselle Crane	25	-	-
4	Eurasian Collared Dove	10	22	-
5	Spotted Dove	11	10	8
6	Rock Pigeon	15	-	-
7	Rose-ringed Parakeet	20	7	-
8	Common Hawk Cuckoo	6	4	-
9	Asian Koel	8	5	-
10	Greater Coucal	5	3	3
11	Asian Palm Swift	-	10	-
12	Common Swift	-	12	5
13	House Swift	-	11	-
14	Indian Roller	8	-	-
15	Green Bee-eater	-	5	10
16	Chestnut-headed Bee-eater	-	-	5
17	Coppersmith Barbet	3	-	10
18	Common Hoopoe	-	-	6
19	Ashy-crowned Sparrow Lark	-	10	-
20	Oriental Skylark	-	15	-
21	Crested Lark	-	15	-
22	Black Drongo	9	7	-
23	Greater Racket-tailed Drongo	10	-	-
24	White-billed Drongo	9	-	-
25	Common Woodshrike	10	-	-
26	Long-tailed Shrike	9	-	-
27	Rosy Starling	500	-	-
28	Jungle Myna	-	16	-
29	House Crow	10	9	4
30	Small Minivet	9	-	14
31	Red-vented Bulbul	10	10	4
32	Yellow-eyed Babbler	-	6	-
33	Large Grey Babbler	23	10	4
34	Common Babbler	-	10	-
35	White-throated Fantail	22	4	2
36	Common Tailorbird	23	5	-
37	Greenish Warbler	12	10	4
38	White-rumped Shama	8	10	3
39	Oriental Magpie Robin	5	3	-
40	Indian Robin	2	2	2
41	Common Stonechat	12	4	3
42	Great Tit	10	7	-
43	Paddyfield Pipit	2	-	7
44	Oriental White-eye	-	-	6
45	Purple-rumped Sunbird	9	5	2
46	Purple Sunbird	5	3	-
47	Indian Silverbill	-	-	14
48	Scaly-breasted Munia	-	-	12
49	House Sparrow	15	20	8
50	Baya Weaver	300	-	-

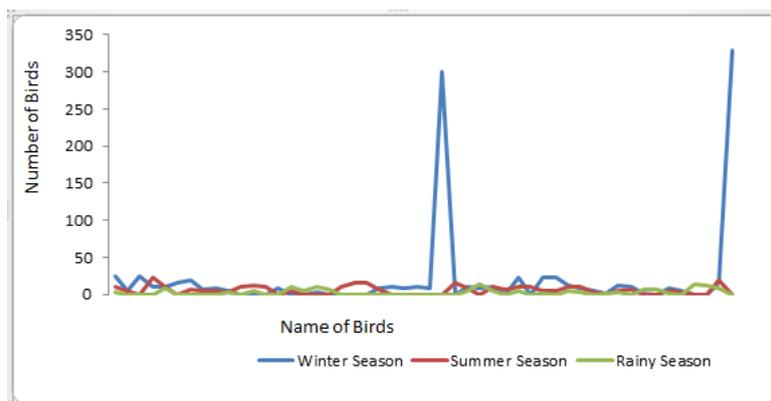


Fig. 1. Graph shows Richness and Diversity of birds in different season.

I observed 97 species of bird visited the agricultural area. Out of that 28 species are wetland habitat, 19 species are forest habitat and 50 species are agricultural habitat. Birds of agricultural area are granivores, frugivores, insectivores and omnivores (Shindsa and Saini 1994, Sekercioglu 2012). Seed- dispersing frugivores ,granivores, omnivores and pollinating nectarivores are higher in agricultural area(Toor et al., 1986). The Simpson Diversity index of birds of agricultural habitat in winter season is 0.35, in summer season is 0.1 and in rainy season is 0.05, it indicate that birds richness and diversity in winter season as compared to summer and rainy season. I also observed that considerable difference in functional distribution, specialization and population size among the agricultural bird communities (Sekercioglu 2010). The population of Starling (*Sturnus roseus*) and Baya Weaver (*Ploceus philippinus*) are more in winter season. Seasonal change in population density and other indices of few species in agricultural area (Toor et al., 1986). The wetland and forest habitat of birds are occasionally or regularly visit agricultural area in three seasons it may be due to replacement of forests with agricultural area and decrease wetlands (Waltert *et al.*,2005, Peh *et al.*, 2006, Leyequie *et al.*,2010,Sekercioglu 2010).

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