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Selection of habitat domain by avifauna of Navegaon National Park (Selected study area) Maharashtra, India

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ABSTRACT

Out of 167 species of birds belonging to 45 families preferred Water Edge (59 species), Cultivation (57 species), Forest Edge (47 species), Forest (45 species), Open Water (24 species), Human Habitation (12 species), Reeds along & in their reservior (12 species), Water Holes (07 species), Forest Floor (06 species) , Rocky Hill (03 species), Floating vegetation (2 species) and Rocks (01 species) as habitat domain in selected study area of Navegaon National Park, Maharashtra throughout the study period of four years from January 2010 to December 2013. The habitat preferences of these 167 species indicate that they occupy a range of habitats, from dry deciduous forest patch to all these habitats, but in different proportions. Such representation of data would prove very helpful to analyze population changes over the years which is one of the pre requisites for any conservation effort in selected study area.

Keywords: avifauna, analysis of population changes, further research, habitat domain, Navegaon National Park.

INTRODUCTION

A habitat is the actual location in the environment where an organism lives and consist of all the physical and biological resources available to a species. Physical and biotic factors may interact to determine the quality of the habitat for a given organism. A niche refers to the way in which an organism fits into an ecological community or ecosystem. The simplest most general definition of the ecological niche is an organisms's "ecological position in the world " (Vandermeer, 1972).

No two species can permenantly occupy exactly the same niche in the same locality as every species has its own perticular niche .The living together of many species in the same community is possible only because their various niche requirements are different .The diversity of flora and insects thriving in the area provides a homely environment for the breeding species of aves. Birds rely on their surroundings for food, safe

shelter and good nesting sites, and these resources vary from habitat to habitat. Habitats typically contain many niches and support many different species (Trivedi, 2004).

Forest is by far the most important habitat for birds, supporting 77% of species (Birdlife International, 2017). The vegetation of Central India is dominated by the Tropical dry deciduous forests as per the classification by Champion and Seth (1968). The dry deciduous forest provide an array of home sites from the top canopy to the forest floor for a number of species of vertebrates as well as invertebrates. These forests are an important habitat for a wide variety of bird species. within a single dry deciduous forest, there are many micro-habitats which are home to specific bird species.

Navegaon National Park comes under Southern Tropical Dry Deciduous forest. Avian community study proves as effective tools for monitoring a forest ecosystem (Jayson and Mathew, 2000). The objective of the present study was to collect scientific information on habitat domain of avifauana of selected study area of Navegaon National Park which will prove useful for further habitat management studies and will provide policymakers with reliable tools to formulate an appropriate policy framework that might reduce the consequences of the threats to the ecosystem posed by the surrounding anthropogenic disturbances. The present work largely deals with the habitat domain study of the representative area which according to many experts is one of the pre requisites for any conservation effort in a particular study area.

MATERIALS & METHODS

Navegaon National Park with total area of 133.88 sq km is situated in Gondia District of Maharashtra State, India and lies between Longitude 80° 5' E to 80° 15' E and Latitudes 20° 45'N to 21° 2' N comes under Southern Tropical Dry Deciduous Type -subgroup 5A (Champion and Seth,1968) (Fig.1.1). Selected study area considered as representative area of the Navegaon National Park is the tourist zone of the park and is 32.398 sq km. The famous Navegaon lake, with an expanse of 11 sq km that provides refuge to the waterfowl and waders, lies to the South -West of the study area. A village named Rampuri is situated adjoining this lake. Here agriculture is practiced. The village and the lake lie outside the South -West boundary of the National Park giving an edge effect to the South-Western side of the Park.

Fig. - Location of Navegaon National Park in Maharashtra

The study area was visited on a monthly basis for a period of four years from January 2010 to December 2013 by the authors accompanied by bird enthusiasts in morning hours when the avian activity is optimum.

Binoculars (Olympus 8X40) were used for collecting the data on the habitat domain of the present avifauna. Digital camera of the brand SONY model-DSC-H7 was used for photographic evidences. "Point-count" method was used for the present study. Local bird experts were interviewed regarding the habitat domain and other details of the avifauna. Revised edition of Grimmett *et.al,* (1998 ,2006) and Ali Salim (1996 and 2002) was followed for the identification, nomenclature and information on species distribution and habitat preferred by avifauna whereas for the global conservation status and population trend of the avifauna , IUCN Red List of Threatened Species - Version 2018-2., http://www.iucnredlist.org was referred (IUCN 2018).

The habitat domain were roughly divided into forest, ecotone, Navegaon lake, cultivation and human habitation. Ecotone is the transition zone from an area of forest to fields or other open spaces. Ecotone area was classified as Forest Edge (FE).

The forest was further divided into detail as Forest Floor (FF), forest (F), Water Holes (WH), Rocky Hill at Agezari (RH) and Rocks at Badabda (R). Navegaon lake was categorized into Water Edge (WE), Reeds along and in the lake (RE), Floating Vegetation (FV) and Open Water (OW). The category "Open Water" was recorded against the birds found at an approximate visual distance of 20 meters from the water edge.

Domain of Human habitation (HH) include the Rampuri village bordered with small trees and bushes. Cultivation (C) comprises of different food crops grown in mixed stands, sharing boundaries with the other habitats. These habitats have been given names and they have been codified according to the suitability of data collection in the field.

RESULT &DISCUSSION

The selected study area provides a variety of habitat domains, thereby catering to different species with different niche and food preferences. A more heterogeneous habitat is suggested to allow the co-occurence of more species (May,1986).

Throghout the study period 167 species belonging to 45 families occupied a wide range of habitat domains from dense decious forest to agricultural patches and other habitats, but in different proportions. Most of the species preferred more than one habitat domain so they were placed in more than one domain (Table 1,2).

Table 1 - Habitat domain preferred by avifauna of Navegaon National Park in selected study area

Sr. No.	Common name	Zoological Name	Habitat codes	Details of the Habitat Domain Preferred
Phasianidae				
1	Indian Peafowl	*Pavo cristatus*	FF/WH	Forest floor, near water holes.
2	Red Junglefowl	*Gallus gallus*	FF/FE	Forest floor, forest clearings.
3	Grey Junglefowl	*Gallus sonneratii*	FF	Forest floor, patches with good undergrowth.
4	Red Spurfowl	*Galloperdix spadicea*	FF/FE	Forest floor, patches with good undergrowth.
5	Painted Spurfowl	*Galloperdix lunulata*	FF	Forest floor near thickets.
6	Jungle Bush Quail	*Perdicula asiatica*	FF	Forest floor in dense dry undergrowth and grass.
7	Rain Quail	*Coturnix coromandelica*	C/FE	Undergrowth.
Columbidae				
8	Yellow-footed Green Pigeon	*Treron phoenicoptera*	F/C/FE	Tall trees like Eucalyptus, Teak, Ficus trees.
9	Laughing dove	*Streptopelia senegalensis*	F/C/HH	Throughout the area on small and medium trees.
10	Spotted Dove	*Streptopelia chinensis*	F/C/HH	Forest floor with grass, medium trees like Babool, Flame of forest, Jamun.
11	Eurasian Collared Dove	*Streptopelia decaocto*	F/C	Middle and lower storey.
12	Emerald Dove	*Chalcophaps indica*	F	Forest clearings near undergrowth.
13	Red Collared Dove	*Streptopelia tranquebarica*	C/FE	Lower storey, farmland.
14	Rock Pigeon	*Columba livia*	C/HH	Fields, lower storey.
Psittaculidae				
15	Rose-ringed parakeet	*Psittacula krameri*	FE/C	Medium and tall trees in the forest and small trees near cultivation.
Cuculidae				
16	Asian Koel	*Eudynamys scolopacea*	FE/C	Small and medium trees, especially fruit trees.
17	Greater Coucal	*Centropus sinensis*	F/FE/C	Small and medium trees, on ground, undergrowth.
18	Common Hawk Cuckoo	*Hierococcyx varius*	F/FE/C	Tall trees like eucalyptus, Jamun, snags.
19	Sirkeer Malkoha	*Phaenicophaeus leschenaultii*	F	Lower storey, undergrowth.
20	Pied cuckoo	*Clamator jacobinus*	FE/C	Middle & lower storey.

Strigidae				
21	Barn Owl	*Tyto alba*	C/HH	On branches of trees at a height of about 4-8 mts.
22	Collared Scops Owl	*Otus bakkamoena*	F/FE	Middle storey, tree holes.
23	Brown Fish Owl	*Ketupa zeylonensis*	F	Dense forest near Agezari water hole.
24	Mottled Wood Owl	*Strix ocellata*	F	Dense canopy of middle storey.
25	Spotted Owlet	*Athene brama*	F/C/HH	Lower or middle storey.
Caprimulgidae				
26	Indian Nightjar	*Caprimulgus asiaticus*	F/FE/C	Small trees in the forest and forest floor.
Apodidae				
27	House swift	*Apus affinis*	RH	Rocky hill at Agezari.
Alcedinidae				
28	White-throated Kingfisher	*Halcyon smyrnensis*	WH	On branches of trees near water.
29	Common Kingfisher	*Alcedo atthis*	RE	Reeds and overhanging branches over water.
30	Pied Kingfisher	*Ceryle rudis*	OW/WE	Hovering over the lake, big boulders near water.
31	Black-capped Kingfisher	*Halcyon pileata*	RE	Spotted only once on the reeds along Navegaon lake.
Meropidae				
32	Green bee-eater	*Merops orientalis*	WE	Near water, low vantage points on bushes, low trees or reeds, about a metre or two in height, Ipomea bushes
33	Blue-tailed Bee-eater	*Merops philippinus*	C/WE	Vantage points near water.
Curacidae				
34	Indian Roller	*Coracias benghalensis*	C	Medium or small trees, vantage points in fields.
Upupidae				
35	Common Hoopoe	*Upupa epops*	C	Lower storey, on ground at farmland.
Bucerotidae				
36	Indian Grey Hornbill	*Ocyceros birostris*	F/FE	Small and medium trees, especially Ficus trees.
37	Malabar Pied Hornbill	*Anthracoceros coronatus*	F	Spotted only once on a Kumbhi tree at Badbada.
38	Great Hornbill	*Buceros bicornis*	NMS	
Capitonidae				
39	Coppersmith Barbet	*Megalaima haemacephala*	F/FE	Middle & lower storey, especially on Ficus trees.
40	Brown-headed Barbet	*Megalaima zeylanica*	F/FE	Middle storey, especially on Ficus trees.
Picidae				
41	Common Flameback		F/FE	Medium and tall trees.
42	Black-rumped Flameback		F/FE	Medium and tall trees
43	Yellow-crowned Woodpecker		F	Medium and tall trees.
44	White-naped Woodpecker		FE/C	Medium and tall trees
45	Rufous Woodpecker		F	Spotted only once on a Tendu tree near T.K. Joint.
46	Brown-cappedPygmy Woodpecker		F/FE	Only two sightings once on a Palas tree at TK-Joint and second time on a Mahua tree on Gampi road.
Pittidea				
47	Indian Pitta	*Pitta brachyuran*	F	Lower branches of medium trees,
Alaudidae				
48	Ashy-crowned sparrow Lark	Eremopterix grisea	C	On ground at farmland.
Hirundinidae				
49	Wire-tailed Swallow	*Hirundo smithii*	WE/OW	Water edge, flying over open water.
50	Barn Swallow	*Hirundo rustica*	WE/OW	Reeds along water edge, flying over open water.
51	Dusky Crag Martin	*Hirundo concolor*	RH	Rocky hill at Agezari.
Laniidae				

52	Long-tailed Shrike	*Lanius schach*	C	Thorny bushes like Babul.
53	Bay-backed Shrike	*Lanius vittatus*	C	Lower branches of thorny trees.
54	Southern Grey Shrike	*Lanius meridionalis*	C	Spotted only once on a lower branch of Ber tree.
Oriolidae				
55	Eurasian Golden Oriole	Oriolus oriolus	F/FE	*Middle storey, on Bombax ceiba in full bloom.*
56	Black-hooded Oriole	Oriolus xanthornus	F/FE	Upper and middle storey.
Dicruridae				
57	Black drongo	*Dicrurus macrocercus*	F/C/HH	Throughout the area, middle & lower storey, vantage points.
58	Greater Racket-tailed Drongo	*Dicrurus paradiseus*	F	Dense Forest, medium and tall trees like Bamboo, Sal, Saja.
59	White-bellied Drongo	*Dicrurus caerulescens*	FE	Spotted only twice, once on Palas tree, the second time on Bija tree.
60	Ashy Drongo	*Dicrurus leucophaeus*	FE	Middle storey, vantage points.
Sturnidae				
61	Common mynah	*Acridotheres tristis*	HH/C	On ground and bushes at farmland.
62	Brahminy Starling	*Sturnus pagodarum*	HH/C	On ground and bushes at farmland, medium and tall trees like Bombax ceiba.
63	Asian Pied starling	*Sturnus contra*	HH/C/WE	On ground and bushes at farmland, near water.
64	Chestnut-tailed Starling	*Sturnus malabaricus*	FE/C	Middle storey, Bombax ceiba was preferred when in blossom.
65	Rosy Starling	*Sturnus roseus*	C/FE	Bombax ceiba.
Corvidae				
66	House Crow	*Corvus splendens*	HH/C	Medium trees near village & cultivation.
67	Large-billed Crow	*Corvus macrorhynchos*	HH/C	Medium trees near village & cultivation.
68	Rufuos Treepie	*Dendrocitta vagabunda*	F/FE	Medium and tall trees in the forest, mostly near waterholes.
Campephagidae				
69	Common Woodshrike	*Tephrodornis pondicerianus*	C	Bushes, low trees near cultivation.
70	Small Minivet	*Pericrocotus cinnamomeus*	FE	Middle storey.
Irenidae				
71	Common Iora	*Aegithina tiphia*	FE	Middle and lower storey.
72	Blue-winged leafbird	*Chloropsis cochinchinensis*	F/FE	Middle storey.
Pycnonotidae				
73	Red-vented bulbul	*Pycnonotus cafer*	F/FE/C	Middle and lower storey.
74	White-browed Bulbul	*Pycnonotus luteolus*	F/ FE/ C	Lower storey, undergrowth of the wooded habitat.
Muscicapidae				
75	Jungle Babbler	*Turdoides striatus*	F/FE/C	Lower storey, undergrowth.
76	Yellow-eyed Babbler	*Chrysomma sinense*	FE/C	Bushes, undergrowth.
Muscicapinae				
77	Tickell's Blue Flycatcher	*Cyornis tickelliae*	F	Middle and lower storey.
78	Asian Paradise Flycatcher	*Terpsiphone paradisi*	F	Middle and lower storey.
79	White-browed Fantail	*Rhipidura aureola*	F/FE	Middle and lower storey.
80	Black-naped Monarch	*Hypothymis azurea*	F/WE	On small trees and undergrowth near the waterhole, small streams.
81	Verditer Flycather	Eumyias thalassina	F/FE	Middle and lower storey.
Sylviinae				
82	Ashy prinia	*Prinia socialis*	C	Bushes, shrubs.
83	Common Tailorbird	*Orthotomus sutorius*	FE/C	Lower storey, undergrowth

Turdinae				
84	Indian Robin	*Saxicoloides fulicata*	C	Bushes, shrubs.
85	Oriental Magpie Robin	*Copsychus saularis*	F/FE/C	Middle and lower storey, undergrowth.
86	Pied Bushchat	*Saxicola caprata*	C	Bushes, crops.
87	White-rumped Shama	*Copsychus malabaricus*	F	Middle & lower storey in dense forest, mostly bamboo clumps.
88	Orange headed Thrush	*Zoothera citrina*	F/FE/WH	Lower storey, near waterholes.
89	Blue Rock Thrush	*Monticola solitarius*	R	Rocks at Badbada.
Motacillidae				
90	Yellow Wagtail	*Motacilla flava*	WE/WH	Near Navegaon lake and waterholes.
91	Grey Wagtail	*Motacilla cinerea*	WE	Near Navegaon lake.
92	White-browed Wagtail	*Motacilla madaraspatensis*	WE/WH	Near Navegaon lake and waterholes.
93	White Wagtail	*Motacilla alba*	WE/WH	Near Navegaon lake and waterholes.
94	Citrine Wagtail	*Motacilla citreola*	WE	Near Navegaon lake.
95	Paddyfield Pipit	Anthus rufulus	C/WE	On ground at farmland, near water.
Dicaeidae				
96	Thick-billed Fowerpecker	Dicaeum agile	FE	Middle and lower storey.
97	Pale-billed Flowerpecker	Dicaeum erythrorhynchos	FE	Middle and lower storey.
Nectarinidae				
98	Purple Sunbird	*Nectarinia asiatica*	FE	Bushes, shrubs and small trees with juicy flowers.
99	Purple-rumped Sunbird	Nectarinia zeylonica	FE	Bushes, shrubs and small trees with juicy flowers.
Zosteropidae				
100	Oriental White-eye	*Zosterops palpebrosus*	FE	Medium trees like Flame of forest.
Ploceidae				
101	House Sparrow	*Passer domesticus*	HH/C	Bushes, shrubs and small trees near village.
102	Chestnut-shouldered Petronia	*Petronia xanthocollis*	F/FE	Lower and middle storey in the forest.
103	Indian Silver bill	*Lonchura malabarica*	C	Bushes and shrubs near the farmland.
104	White-rumped Munia	*Lonchura striata*	C/WH	Farmland or thickets near waterholes
105	Red Munia	*Amandava amandava*	C/WE	Farmland, water edge.
106	Black-headed Munia	Lonchura Malacca	C/FE	Bushes,shrubs around farmland.
107	Scaly-breasted Munia	*Lonchura punctulata*	C	Bushes, shrubs around farmland.
108	Baya Weaver	*Ploceus philippinus*	C/WE	Nesting on Babool tree.
109	Black-breasted Weaver	Ploceus benghalensis	C	Tall and thick grass in the farmland.
Accipitridae				
110	Shikra	*Accipiter badius*	F/FE	Upper & middle storey.
111	Black-shouldered Kite	Elanus caeruleus	C	Snags, lower storey or hovering over farmland.
112	Black-kite	Milvus migrans govinda	WE	Medium trees near Navegaon lake.
113	White-eyed Buzzard	*Butastur teesa*	FE	Middle storey.
114	Oriental Honey-Buzzard	Pernis ptilorhyncus	F	Upper and middle storey.
115	Crested Serpent Eagle	*Spilornis cheela*	F	Upper & middle storey.
116	Changeable Hawk Eagle	*Spizaetus cirrhatus*	F	Upper & middle storey at Badbada.
117	Short-toed Snake Eagle	Circaetus gallicus	C	Hovering high over the cultivated land.
118	Eurasian Marsh Harrier	Circus aeruginosus	OW/WE/RE	Flying over open water, near the reeds at water edge.
Falconidae				
119	Common Kestrel	*Falco tinnunculus*	C	Spotted only twice, once hovering over farmland, the second time on a Babul tree.
120	Peregrine Falcon	*Falco peregrines*	RH	Rocky hill at Agezari.

Anatidae				
121	Lesser Whistling-Duck	*Dendrocygna javanica*	OW/WE	Open water, Ipomea bushes at water edge.
122	Ruddy Shelduck	*Tadorna ferruginea*	OW/WE	Foraging in open water, roosting on water edge.
123	Northern Pintail	*Anas acuta*	OW/WE	Foraging in open water, roosting on water edge.
124	Garganey	*Anas querquedula*	OW/WE	Foraging in open water, roosting on water edge among reeds.
125	Northern Shoveler	*Anas clypeata*	OW/WE	Foraging in open water, roosting on water edge.
126	Common Teal	*Anas crecca*	OW/WE	Foraging in open water, roosting on water edge.
127	Red-crested Pochard	*Rhodonessa rufina*	OW/WE	Foraging in open water, roosting on water edge.
128	Common Pochard	*Aythya ferina*	OW/WE	Foraging in open water, roosting on water edge.
129	Tufted Duck	*Aythya fuligula*	OW/WE	Foraging in open water, roosting on water edge.
130	Gadwall	*Anas strepera*	OW/WE	Foraging in open water, roosting on water edge.
131	Eurasian Wigeon	*Anas penelope*	OW/WE	Foraging in open water, roosting on water edge.
132	Spot-billed Duck	*Anas poecilorhyncha*	OW/WE	Foraging in open water, roosting on water edge.
133	Cotton Pygmy-goose	*Nettapus coromandelianus*	OW	Open water, didn't spot this species out of water.
134	Comb Duck	*Sarkidiornis melanotos*	OW/WE	Foraging in open water, roosting on water edge.
Ciconidae				
135	Painted Stork	*Mycteria leucocephala*	WE	Foraging or roosting at water edge.
136	Asian Openbill	*Anastomus oscitans*	WE	Foraging or roosting at water edge.
137	Lesser Adjutant	*Leptotilos javanicus*	WE	Spotted only once foraging along the water edge.
138	Black-headed Ibis	*Threskiornis melanocephalus*	WE	Foraging or roosting at water edge.
139	Black Ibis	*Pseudibis papillosa*	C/WE	Foraging at water edge or on farmland.
140	Eurasian Spoonbill	*Platalea leucorodia*	WE	Foraging or roosting at water edge.
Ardeidae				
141	Grey Heron	*Ardea cinerea*	RE/WE	Foraging or roosting at water edge near the reeds.
142	Purple Heron	*Ardea purpurea*	RE/WE	Stalking for prey or roosting at water edge near the reeds.
143	Indian Pond Heron	*Ardea purpurea*	C/WE	Stalking for prey along water edge or cultivation.
144	Little Heron	*Butorides striatus*	WE	Water edge.
145	Black-crowned Night Heron	*Nycticorax nycticorax*	RE/WE	Roosting on trees at water edge or stalking for prey along water edge.
146	Cinnamon Bittern	*Ixobrychus cinnamomeus*	RE/WE	Roosting or foraging in the reed beds at water edge.
147	Little egret	Egretta garzetta	WE	Foraging at the water edge.
148	Great Egret	Casmerodius albus	RE/WE	Among the reeds at water edge.
149	Intermediate Egret	Mesophoyx intermedia	WE	Foraging along the water edge.
150	Cattle Egret	Bubulcus ibis	C/WE	Mostly farmland, sometimes water edge.
Podicipedidae				
151	Little Grebe	*Tachybaptus ruficollis*	OW	Open water.
152	Darter	Anhinga melanogaster	OW/WE	Open water or on trees along the water edge.
153	Little Cormorant	Phalacrocorax niger	OW/WE	Open water, trees and rocks along water edge.
Rallidae				
154	White-breasted Waterhen	Amaurornis phoenicurus	WE	Water edge.
155	Purple Swamphen	*Porphyrio porphyrio*	RE/WE	Reeds along the water edge.
156	Common Moorhen	*Gallinula chloropus*	RE	Among the reeds.
157	Common Coot	*Fulica atra*	OW	Open water.

Jacanidae				
158	Pheasant-tailed Jacana	*Hydrophasianus chirurgus*	FV/RE/WE	Floating vegetation, reeds, near water edge.
159	Bronze-winged Jacana	*Metopidius indicus*	FV/RE/WE	Floating vegetation, reeds, near water edge.
Charadriidae				
160	Red-wattled Lapwing	*Vanellus indicus*	WE/C	Not far from water.
161	Wood Sandpiper	Tringa glareola	WE	Foraging along water edge.
162	Common Sandpiper	Actitis hypoleucos	WE	Foraging along water edge.
163	Common Greenshank	*Tringa nebularia*	WE	Foraging along water edge.
164	Little Ringed Plover	*Charadrius dubius*	WE	Foraging along water edge.
Recurvirostridae				
165	Black-winged Stilt	Himantopus himantopus	WE	Foraging in water not far from the edge.
Laridae				
166	Brown-headed Gull	*Larus brunnicephalus*	OW	Spotted only once in open water of Navegaon lake.
167	River Tern	*Sterna aurantia*	OW/WE	Flying over open water, roosting at water edge.

F = Forest ; FF = Forest Floor ; FE = Forest Edge ; C = Cultivation ; HH = Human Habitation ; RH = Rocky Hill (at Agezari) ; R = Rocks (at Badbada) WH = Water holes ; RE = Reeds along & in the reservoir ; OW = Open Water ; WE = Water edge ; FV = Floating Vegetation ; NMS = Need More Study

Table2 - Familywise analysis avifauna at Navegaon National Park in selected study area

Sr. No.	Family	Count of Species	Habitat Domain codes	Sr. No.	Family	Count of Species	Habitat Domain codes
1	Phasianidae	7	FF ,FE ,WH, C	24	Irenidae	2	F,FE
2	Columbidae	7	F,C,FF HH,	25	Pycnonotidae	2	F,C,FE
3	Psittaculidae	1	FE,C	26	Muscicapidae	2	F,FE,C
4	Cuculidae	5	F, FE, C	27	Muscicapinae	5	F,FE,WE
5	Strigidae	5	C,HH,F,FE,	28	Sylviinae	2	C,FE
6	Caprimulgidae	1	FE,F,C	29	Turdinae	6	F,C,FE,WH,R
7	Apodidae	1	RH	30	Motacillidae	6	WE,WH,C
8	Alcedinidae	4	WH,RE,OW,WE	31	Dicaeidae	2	FE
9	Meropidae	2	WE,C	32	Nectarinidae	2	FE
10	Curacidae	1	C	33	Zosteropidae	1	FE
11	Upupidae	1	C	34	Ploceidae	9	HH,C,F,FE,WE,WH
12	Bucerotidae	2	F,FE,NMS	35	Accipitridae	9	F,FE,C,WE,OW,RE
13	Capitonidae	2	F,FE	36	Falconidae	2	C,RH
14	Picidae	6	F,FE,C	37	Anatidae	14	OW,WE
15	Pittidea	1	F	38	Ciconidae	6	C,WE
16	Alaudidae	1	C	39	Ardeidae	10	C,RE,WE
17	Hirundinidae	3	F/FE/C	40	Podicipedidae	3	OW,WE
18	Laniidae	3	C	41	Rallidae	4	WE,RE,OW
19	Oriolidae	2	F,FE	42	Jacanidae	2	FV,RE,WE
20	Dicruridae	4	F,FE,,C HH	43	Charadriidae	5	C,WE
21	Sturnidae	5	C,HH,WC,FE,C	44	Recurvirostridae	1	WE
22	Corvidae	3	C,HH, F,FE	45	Laridae	2	WE,OW
23	Campephagidae	2	FE,C				

F = Forest ; FF = Forest Floor ; FE = Forest Edge ; C = Cultivation ; HH = Human Habitation ; RH = Rocky Hill (at Agezari) ; R = Rocks (at Badbada) WH = Water holes ; RE = Reeds along & in the reservoir ; OW = Open Water ; WE = Water edge ; FV = Floating Vegetation ; NMS = Need More Study

Table 3: Habitat Domain wise analysis of avifauna at Navegaon National Park in selected study area

Sr. No.	Habitat	Habitat Domain	Domain Code	No. of species	Total No.
1	Ecotone	Forest Edge	FE	47	47
2	Forest	Forest	FF	45	62
3		Water holes	WH	7	
4		Forest Floor	F	6	
5		Rocky Hill (at Agezari)	RH	3	
6		Rocks (at Badbada)	R	1	
7	Navegaon Lake	Water edge	WE	59	97
8		Open Water	OW	24	
9		Reeds along & in the reservoir	RE	12	
10		Floating Vegetation	FV	2	
11	Cultivation	Cultivation	C	57	57
12	Human Habitation	Human Habitation	HH	12	12

The habitats were represented as forest, Navegaon lake, cultivation, human habitation and ecotone. Ecotone is the transition zone from an area of forest to fields or other open spaces. Ecotone area was classified as Forest Edge domain (FE). Navegaon Lake was the dominating habitat preferred by 97 species and further classified into Water edge (WE), Open Water (OW), Reeds along & in the reservoir (RE) and Floating Vegetation (FV) (Table 3).

''Water edge" was the most preferred domain as maximum number of species (59 sp.) were noted to occupy this domain which was followed by Open water (24sp.), Reeds along & in the reservoir (12 sp.) and Floating Vegetation (2 sp.). Each organism maintains specific relation with the environment in which it lives. Birds like kingfisher, bee eater, swallow, wagtail, ducks, bird of prey, spoonbill, herrons, egrets and various aquatic birds were spotted in these domains. These relations entail different environmental parameters eg. temperature, humidity, diet requirements etc. (Blair, 2001). Wetlands are relatively safe areas which provide the birds with abundance of food and safe place for roosting, nesting and moulting. Wetlands play major role in the landscape by providing unique habitats for a wide variety of flora and fauna (Imran Dar and Mithas Dar, 2009). Chinchkhede and Kedar (2012) observed Srinagar lake as habitat domain of 59 species of birds near Navegaon National Park.

Forest habitat occupied 62 different species in the domains of Forest (F), Water holes (WH), Forest Floor (F), Rocky Hill (at Agezari) (RH) and Rocks (at Badbada) (R). Forest Vegetation domain was preferred by 45 species which was followed by Water holes (7 sp.). Pigeon, dove, cuckoo, hornbill, barbet, woodpecker, oriole, drongo, flycatcher, eagle, shikra, etc were spotted in these domains. swift, martin and peregreen flcon were spottted in Rocky Hill at Agezari. Blue rock thrush was spotted in Rocks at Badbada. One of the major factors determining the bird numbers and species diversity of specific habitat domain is the availability of food, suitable field conditions and easy availability of protein-rich invertebrates and other food (Rajashekara and Venkatesha, 2014). Some previous studies have demonstrated the positive relationship between bird species with both, number of large native trees; and the diversity and biomass of invertebrate food potential of edge features (Douglas et al., 2014).

Cultivation' habitat domain was prefered by 57 species and that of Ecotone habitat domain type was prefered by 47 species. The abundance of birds in forest, cultivation and ecotone domain was not significantly different from one another and was also in the same way influenced by the abundance of tree. The ecotone between the forest and open habitat is usually dominated by light-demanding vegetation species (such as shrubs and pioneer trees), which provide a diversity of flowers and fleshy fruits, usually consumed by forest birds (Oosterhoorn and Kappelle, 2000). Landscapes dominated by agriculture and open pasture are often also more fragmented; consequently, species in such landscapes are forced to utilize suboptimal habitats and move closer to edges (Zurita and Bellocq, 2010). The edge effects could also have

played a marked role in the population dynamics of the birds in these habitat domains (Evans et al., 2016).

Human Habitation domain type was prefered by 12 species only. Species like dove, pigeon, owl, owlet, drongo, myna, crow and sparrow were spotted in this domain. These were also spotted in forest, cultivation and water edge too (Table 2), We observed that a significant proportion of birds (70 % on average) avoid human habitation. The capacity of native species to use anthropogenic habitats or to move through them is one of the main determinants of landscape functional connectivity (Hansbauer et al. 2008). Some species may be completely restricted to native habitat cores and perceive anthropogenic habitats as impermeable for dispersal, whereas other species may use a variety of habitats, including anthropogenic habitats, and correspondingly perceive them as highly permeable for dispersal (Gillies and St. Clair, 2010).

In previous study of the same area from January 2010 to December 2012, 126 species were observed by the author (Chinchkhede and Kedar, 2013). The availability of food appears to be one of the major factors determining the bird numbers and species diversity of specific area (Prajapati *et al.,*2008). The forest is composed of 40 species of trees ,16 species of shrubs and 44 species of herbs which serves as a living repository of the flora providing ideal habitat for the resting, feeding and breeding of birds (Ilorkar and Khatri, 2003). The relative abundance of avian species in an area usually is related to the availability of main life requirements i.e. food, water and shelter, as well as suitable weather conditions (Issa, 2019).

Indian Gey Hornbill (*Ocyceros birostris*) and Malabar Pied Hornbill (*Anthracoceros coronatus*) of the family Bucerotidae were spotted in Small and medium trees, especially Ficus trees and Kumbhi tree at Badbada in forest and forest edge domain while sighting of the Great Hornbill (*Buceros bicornis*) was reported by locals and forest guard. During our surveys we could not sight it ourselves. The bird has been included in the checklist as the report were consistent and reliable. In our openion the species needs much more consistent and excessive surveys to update its present trend of occurence and population and to confirm its habitat domain in the selected study area.

The ecological niche involves not only the physical space occupied by an organism, but also its functional role in the community and its position in environmental gradients (Verma and Agrawal, 2008). The abundance and diversity of avian species in a specific habitat could serve as a useful barometer of the ecological status of that habitat (Bibi and Ali, 2013). High density of birds in twelve different habitat domains of Navegaon National Park shows that this ecosystem fulfils most of the requirements to become the important refuge of the birds.

A number of taxonomic and functional groups are well represented in this region, including waterfowl, forest birds, birds that prefer cultivation, etc. Generally speaking, all terrestrial and aquatic habitats within the study area provide some functional value to resident as well as migratory avian species for foraging, reproduction, and concealment from predators. The habitat preferences of these 167 species indicate that they occupy a range of habitats, from dry deciduous forest patch to all these habitats, but in different proportions.

CONCLUSION

Only a relatively small area of the park was studied on a regular basis. Therefore, addition of more number of species to the present list seems to almost certain in future after detail surveys. Such representation of data would prove very helpful to analyze population changes over the years which is one of the pre requisites for any conservation effort in selected study area.

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Conflict of Interest

The author declares that there is no conflict of interest.

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