

MISCELLANEOUS NOTES

11. CRANES WINTERING IN SAURASHTRA

In January-February 1983 I had an opportunity to travel in the Saurashtra region of Gujarat in the company of Dr J Van der ven, chief of the Nature Conservation Department in the Netherlands. In visiting the wetlands and reservoirs of Saurashtra, our main purpose was to look for the wintering numbers of Demoiselle (*Anthropoides virgo*) and Common (*Grus grus*) cranes; but such was the richness of the avifauna encountered, that it was impossible to restrict oneself merely to cranes. However, cranes being our first concern, the estimated numbers of cranes observed at different reservoirs are given below:

DATE	NAME OF WETLAND	NUMBER OF		
		DEMOISELLE	COMMON	SARUS
27 Jan.	Lalpari (Rajkot)	5000	Nil	Nil
"	Veri (Gondal)	Nil	25	2
28 Jan.	Sayala	250	300	4
"	Thoriari	35	Nil	Nil
"	Muli	2000	Nil	Nil
29 Jan.	Kharaghoda (Little Rann)	Nil	3000	Nil
31 Jan.	Vijaysagar (Kutch)	Nil	25	6
31 Jan.	Jodiya	Nil	12	2
1 Feb.	Singach	100	Nil	Nil
2 Feb.	Alansagar (Jasdan)	1000	Nil	Nil
"	Ponelia	Nil	7	Nil
"	Brahmani	25	Nil	Nil
3 Feb.	Nyari (Rajkot)	3000	Nil	Nil
4 Feb.	Mitana (Morvi)	3000	400	Nil
"	Ramdarda (Rajkot)	500	Nil	Nil

(The estimates are rounded to the nearest hundred.)

In addition small flocks of Common cranes numbering 10 to 25 birds were observed in flight several times. Distant views of large flocks believed to be of Demoiselles, were also seen especially around Rajkot and Jamnagar. In all, we must have seen an estimated 25,000 cranes belonging to both the species.

Pairs and small flocks of Sarus were also seen. But Sarus appears to have a very dispersed distribution and is by no means common in Saurashtra.

Sightings of cranes indicate that Demoiselles were more common in the west while, as you travel from west to east, the Common becomes more numerous.

The daily routine of cranes appears to be as follows: The cranes leave roosting areas which are normally on the banks of reservoirs, early in the morning to feed in fields on fallen groundnut of previous harvest. They return to the roosting sites between 10.30 and 11.30 a.m. to spend the noon and afternoon there. In the evening around 5 p.m. they go out again to feed and return to the roost in gathering dusk. Common cranes were also seen feeding in *jowar* and *gram* fields.

A number of juveniles were seen among flocks of Common cranes, though not many among Demoiselles. On two occasions a Demoiselle pair with a young was seen feeding away from the main flock.

On the whole, cranes permitted a fairly close approach and were not unduly scared by our presence. In certain areas like Sayala, where they are protected by the local people, they were even tamer.

All the reservoirs and wetlands also presented a rich diversity of aquatic birds. Shovellers were seen to outnumber all other ducks, though sizeable numbers of Pochard and Tufted Duck were seen. Over two thousand White and a few Grey Pelicans were also seen. The Khijadiya wetland encompassing freshwater and saltwater habitats, is extremely rich in waterbirds including Pelican, Greater and Lesser Flamingo, storks, heron and egrets, various ducks, avocets and curlews

and other waders, coots and moorhens. This extensive marshland may very well be a candidate for inclusion in the Ramsar list as a wetland of international importance.

The lake in the centre of Jamnagar, a busy industrial town, is a veritable paradise for

birdwatchers. Scores of Greater Flamingos, hundreds of ducks, waders, terns and coots and many cormorants, darters, ibises and moorhens, not to say skimmers, crowd this shallow lake.

277 SINDH HOUSING SOCIETY,
PUNE-411 007,
May 4, 1983.

PRAKASH GOLF

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277 SINDH HOUSING SOCIETY,
PUNE-411 007,
May 4, 1983.

PRAKASH GOLE

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A MARCH BIRD COUNT IN POONA

Prakash Gole

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PRAKASH GOLE²

How many birds are there in an Indian city? To arrive at an estimate of the bird population of the city, a group of twenty bird-watchers from Poona decided to pool their energies to make a bird-count. The city was divided into sectors and a pair or group of bird-watchers was allotted one sector to make notes and count species and individuals. All birds that could be seen and heard (and definitely identified) while moving along the streets and lanes were counted. There are certain groups of trees in the city and on its river-banks which are favoured by birds for roosting. Counts of common Indian mynah, house and jungle crow, cattle and little egrets and pond herons were chiefly made at these places.

It was not possible to cover the city area in one day. Sectors had to be divided into sub-sectors. Each sub-sector was visited once to avoid double counting. Of course, a certain percentage of double counting is unavoidable as birds are highly mobile. However, care was taken to avoid it, mainly by restricting the count of such mobile birds as crows and mynahs to their roosting sites only. The total effort was spread over the duration of a week—the first week of March 1979.

During the week 130 bird-species were noted with a total population of more than 22,000 individuals. The count was spread over about 12,120 hectares or about 30,000 acres. The

area includes the main wards of the city and the cantonment but excludes suburban areas such as Kirkee, Yerawada, Ghorpadi, Katraj, Hingne and some other small areas on the periphery. Out of the total area included in the bird-count about 60% was more or less fully covered, 24% partially covered, while over about 16% of the area observations were poor. Our coverage of garden birds was poor for obvious reasons. We could not enter private gardens and had to restrict counting to public parks and gardens only.

The total of about 22,000 birds counted gives a figure of less than one bird per acre or 1.8 birds per hectare. The actual number of birds per hectare is probably greater. As already pointed out, our coverage of garden birds was poor. Even if the number of garden birds is increased by 100 p.c., we will still be erring on the safe side. Our coverage of water-birds and birds of grasslands and fields, is better, believed to be around 60 p.c. This also includes common birds like house sparrow, house and jungle crow and common mynah. A 40 p.c. increase in the number of all these birds may not probably be out of proportion. These adjustments give us a total of about 32000 birds, i.e. 1.06 birds per acre or 2.6 birds per hectare. Comparable figures for other Indian cities are not available. However, for Inner London area a density of 0.9 to 1.75 breeding pairs per acre, has been given by Murton (Murton R. K. MAN & BIRDS, 1971).

It must be made clear that the figure includes migratory birds, both local and conti-

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² 277 Sindh Housing Society, Poona-411 007, (M.S.).

mental. A count taken in June and July will probably show a lower density as most of the migratory birds will have left by then. However, these migrants spend almost eight months of the year (September to April) in our land and there is no reason why we should exclude them while estimating the bird population of a particular area.

Admittedly, the count was weighted in favour of birds which are commensals of man namely house sparrow and crow, mynah and parakeet, pariah kite and blue rock pigeon. In Murton's figures also 88 p.c. of the breeding birds are feral pigeons and house sparrows. Here, the common Indian mynah formed almost a third of the total number of individuals. The mynah outnumbered the crow and the sparrow by almost 2 to 1. Not all the mynahs forage within the city however. They are commuters, flying out every morning to fields and grasslands to feed and flying in to roost each evening. We were surprised to find the number of house sparrows so low (1600). Probably these drab-coloured birds failed to attract our attention. Big flocks of sparrows were seen mainly in the evening when numbers collected and flew to roost. One roosting tree near the railway station attracted more than 500 of them.

Even crows were found to be more numerous than the house sparrow. About 2500 of them were counted. It was not always possible to distinguish between a house and a jungle crow, as counts were made mainly in the evenings. We suspect however, that there are as many jungle crows as there are house crows.

Early in the morning crows appeared to be the first to wake up and move about; while in the evening they were preceded by the common mynah for roosting. They flew in to roost in flocks of 20-30 or gangs of 5-10, in a leisurely fashion, flying at about tree-top height.

Sometimes they used to make a sudden stoop on to a tree on the way, the flying army arresting flight suddenly and diving down to alight on the tree to the accompaniment of much noise. After a pause they continued their flight. They also perched on adjacent buildings before settling on the roosting trees. Even after reaching these trees some took to wing, flew about, made a detour only to come back to settle on the trees.

The common mynah roosts were nothing short of spectacular. At one roost more than 4000 mynahs were counted. They flew in to roost in flocks of 2-4, 7-8, 20-30 and 30-50. Most of them flew at moderate heights, though some coming into city from the west over the hills flew higher. Before reaching the trees mynahs too collected first in a convenient spot, a hill-slope, a grassy patch on a river-bank, even a tall theatre-building. Here they made a pause of 15 to 30 minutes before flying in *en masse* into the trees to the accompaniment of a deafening cackle.

House and jungle crows were found to be associating with common mynahs on all the roosts; while at one roost near the river about 350 cattle and little egrets and 325 pond herons came to roost with the mynahs and crows. They however, occupied acacia trees while the latter roosted on the banyan, the peepul and the rain tree. Egrets came in flocks of 10 to 25 birds, flying along the course of the river, while pond herons came one by one. Brahminy mynahs have smaller roosts scattered all over the city. They do not associate with the common mynah but roost separately in groups of 5 to 50. Normally in the first fortnight of March every year, rosy pastors arrive and spend some days in the city. They also were seen to roost with the common mynah. 400 were counted at one roost alone.

While the mynah roosts are mostly in the

BIRD COUNT IN POONA

central, southern and western parts of the city, the rose-ringed parakeet prefers chiefly the Koregaon Park area to the east. In the evening they were seen to fly energetically in groups of 20-40 birds to settle in large banyan and peepul trees. Smaller groups coalesced into larger ones as roosting trees drew near and they used to settle with an incessant chatter which normally went on with interruptions till late at night. They appear to be late-risers too, leaving the roost after sunrise when most of the other birds are up and about. More than 1000 parakeets roost there.

As in other Indian cities some pariah kites and whitebacked vultures are usually to be seen quartering the skies of Poona city. Kites were found to be numerous in the Cantonment area and in early mornings these handsome birds were very active, diving, swooping on the ground for tit-bits and squealing. Breeding season of these birds was on and on a busy thoroughfare a nest with a sitting bird could easily be seen on a peepul tree about 10 metres up from the street level. Most of the vultures scavenge near the bone-crushing plant located at south-east of the city. Compared to whitebacked vultures, the number of neophron vultures was insignificant.

Out of the 130 species counted, 35 may be called garden and woodland birds which including bulbuls, magpie and Indian robins, sunbird, barbet, warblers, flycatchers, tit, woodpecker, flowerpecker, koel, golden oriole, iora, grey hornbill, white-eye, little minivet, spotted owlet etc. 37 species belonged to grassland, scrub and fallow-land. These included drongo, shrikes, babblers, munias, quails, bushchats, pipits, larks, doves, bee-eater, hoopoe, Indian roller, yellow-wattled lapwing, crested bunting etc. Ten species of birds of prey were recorded. They included three eagle species, blackwinged and large Indian kite, kestrel,

shikra, sparrow-hawk, redheaded merlin and marsh harrier.

Poona's river banks harbour a rich variety of bird-life; 110 species have so far been recorded in the Mula-Mutha Bird Sanctuary area alone. During the present count 39 species of water-birds were recorded. These included dabchick, kingfishers, wagtails, coots, terns, egrets, swallows, ducks like garganey teal and pintail, and a variety of waders such as black-winged stilt, sandpipers, green and redshanks, little ringed plover, little stint, jacanas etc.

Out of the 130 bird species, 90 species were resident birds and the remaining migratory. Of the latter 18 are known to breed within Indian limits, but migrate either locally from the north or from the Himalayas. These included Indian Roller, collared bushchat, black-winged stilt, black redstart, blue rock thrush, lesser whistling teal etc. Species that habitually migrate over long distances numbered 22. They are winter visitors to our land and included ducks like garganey teal and pintail, wagtails, rosy pastors, desert wheatears etc.

What other peculiarities of bird-life could be noted during the count? As the breeding season was approaching songsters were slowly getting into form. Though the redvented bulbul and the magpie robin were not yet in full song, calls of iora and golden oriole could be heard. The koel was making feeble attempts to produce its characteristic call; the male would burst into his full song towards the end of the month. Surprisingly, a hawk-cuckoo was vocal in a park even though the weather was clear and sunny.

Pair-formation was still in its initial stages. The male magpie robin chased the female desultorily and without any fervour. The Indian robin had paired already but feeding of the female by the male could not yet

be observed. The rufousbacked shrike uttered harsh notes from a tree or a telegraph cable as if proclaiming territorial rights but his mate was nowhere nearby. The purple sunbird was not yet in full breeding plumage and the male and the female foraged separately.

Cattle and little egrets and pond herons and pheasant-tailed jacanas were also not yet in breeding plumage. However, some dabchick pairs were busy constructing their floating nests near the far end of a reed-bed; while one pair of dabchick had already laid and was incubating a clutch of two eggs. On a steep bank even a small blue kingfisher was seen excavating a nest-hole.

Most of the migrants were still to be found in the city. The Indian redstart was still here though most would leave by the 10th. Blyth's reed and greenish leaf warblers could still be heard in the trees and in the morning the brilliant blossom of the silk cotton attracted hordes of chattering rosy pastors who would proceed north around 15th March. The blue rock thrush still lurked in the eaves of tall buildings and on hills and among boulders on the river bank. The Indian roller on the telegraph pole, the collared bush-chat on a bush-top, a bluethroat in a reed-bed and a lesser whitethroat skulking in bushes, was still a common sight. Some of the yellow wag-tails had donned their distinctive dress and the greyheaded, the blueheaded and the blackheaded could be distinguished. Even some of the blackwinged stilts had put on their black caps, their restless flocks flying to and fro on the river. Most of the other waders appeared a shade brighter but still hunted singly or in flocks. Gatherings of common swallows hawked insects in the sky morning and evening though the number of redrumped swallows appeared to be surprisingly low.

Moreover, there was a large influx of ducks, presumably returning from the south, in the Mula-Mutha Bird Sanctuary and the Pashan reservoir. The number of garganey teals had shot up from a hundred to over 500. Some pintails and redcrested pochards could also be seen among them. At this time and at this time only, a flock of lesser whistling teals visits Pashan reservoir every year. It was dutifully there this year also.

On the outskirts of the city, song of the redwinged bushlark and the Indian skylark was increasingly evident. On barren patches pairs of yellow-wattled lapwing could be seen silently creeping away from the observer. Here they will lay in the first week of April. Flocks of spotted and red munias gathered seeds quietly in grassland and along dusty tracks and baya flocks zoomed from tree to tree as if in search of a suitable nesting place.

A short-toed eagle, a few blackwinged kites and an occasional tawny eagle are usually to be seen on the periphery of the city. The great army of tawny eagles that at one time patronised the garbage dump is now no longer there. A large Indian kite, a booted eagle and a few marsh harriers were recorded on the river and reservoirs, while a kestrel, a shikra and a sparrowhawk were encountered in better wooded areas. Interestingly, for the last three years a pair of redheaded merlins have nested on the market-place tower in the busiest and most densely populated part of the city.

Such is the glimpse in the life of birds of a busy Indian city. For us city-dwellers it was an exciting and thrilling experience to count birds and record their characteristics. As the city continues to grow it will unwittingly affect the lives of its birds, until a stage comes when its citizens may feel like having a second look at the birds living in it.

BIRD COUNT IN POONA

TABLE 1
LIST OF BIRDS OBSERVED DURING THE BIRD-COUNT

Scientific Name	English Name
1. <i>Podiceps ruficollis</i>	Indian Little Grebe
2. <i>Phalacrocorax niger</i>	Little Cormorant
3. <i>Ardeola grayii</i>	Indian Pond Heron
4. <i>Bubulcus ibis</i>	Cattle Egret
5. <i>Egretta intermedia</i>	Indian Smaller Egret
6. <i>Egretta garzetta</i>	Little Egret
7. <i>Dendrocygna javanica</i>	Lesser Whistling Teal
8. <i>Anas querquedula</i>	Garganey Teal
9. <i>Nettapus coromandelianus</i>	Cotton Teal
10. <i>Anas acuta</i>	Pintail
11. <i>Elanus caeruleus</i>	Blackwinged Kite
12. <i>Milvus migrans</i>	Common Pariah Kite
13. <i>Milvus migrans lineatus</i>	Large Indian Kite
14. <i>Butastur teesa</i>	White-eyed Buzzard
15. <i>Gyps bengalensis</i>	White-backed Vulture
16. <i>Neophron percnopterus</i>	White Scavenger Vulture
17. <i>Circus aeruginosus</i>	Marsh Harrier
18. <i>Circaetus gallicus</i>	Short-toed Eagle
19. <i>Spilornis cheela</i>	Crested Serpent Eagle
20. <i>Aquila rapax</i>	Tawny Eagle
21. <i>Falco chicquera</i>	Red-headed Merlin
22. <i>Falco tinnunculus</i>	Kestrel
23. <i>Accipiter badius</i>	Shikra
24. <i>Hieraëetus pennatus</i>	Booted Hawk Eagle
25. <i>Accipiter nisus</i>	Sparrow-hawk
26. <i>Perdicula argoondah</i>	Rock Bush Quail
27. <i>Amaurornis akool</i>	Brown Crake
28. <i>Amaurornis phoenicurus</i>	Whitebreasted Waterhen
29. <i>Gallinula chloropus</i>	Indian Moorhen
30. <i>Fulica atra</i>	Coot
31. <i>Porphyrio porphyrio</i>	Purple Moorhen
32. <i>Hydrophasianus chirurgus</i>	Pheasant-tailed Jacana
33. <i>Vanellus indicus</i>	Red-wattled Lapwing
34. <i>Vanellus malabaricus</i>	Yellow-wattled Lapwing
35. <i>Charadrius dubius</i>	Little-ringed Plover
36. <i>Tringa totanus</i>	Redshank
37. <i>Tringa nebularia</i>	Greenshank
38. <i>Tringa ochropus</i>	Green Sandpiper
39. <i>Tringa glareola</i>	Wood Sandpiper
40. <i>Tringa hypoleucos</i>	Common Sandpiper
41. <i>Capella gallinago</i>	Common Snipe
42. <i>Calidris minutus</i>	Little Stint
43. <i>Philomachus pugnax</i>	Ruff & Reeve
44. <i>Himantopus himantopus</i>	Black-winged Stilt

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Scientific Name	English Name
45. <i>Rostratula benghalensis</i>	Painted Snipe
46. <i>Chlidonias hybrida</i>	Whiskered Tern
47. <i>Gelochelidon nilotica</i>	Gull-billed Tern
48. <i>Columba livia</i>	Blue Rock Pigeon
49. <i>Streptopelia chinensis</i>	Spotted Dove
50. <i>Streptopelia senegalensis</i>	Little Brown Dove
51. <i>Psittacula krameri</i>	Roseringed Parakeet
52. <i>Psittacula cyanocephala</i>	Blossom-headed Parakeet
53. <i>Cuculus varius</i>	Common Hawk-cuckoo
54. <i>Eudynamys scolopacea</i>	Koel
55. <i>Centropus sinensis</i>	Crow-pheasant
56. <i>Athene brama</i>	Spotted Owlet
57. <i>Apus affinis</i>	House Swift
58. <i>Halcyon smyrnensis</i>	White-breasted Kingfisher
59. <i>Alcedo atthis</i>	Common Kingfisher
60. <i>Ceryle rudis</i>	Lesser Pied Kingfisher
61. <i>Merops orientalis</i>	Small Green Bee-eater
62. <i>Coracias benghalensis</i>	Indian Roller
63. <i>Upupa epops</i>	Hoopoe
64. <i>Tockus birostris</i>	Grey Hornbill
65. <i>Megalaima haemacephala</i>	Crimson-breasted Barbet
66. <i>Picoides maharattensis</i>	Mahratta Woodpecker
67. <i>Eremopterix grisea</i>	Ashy-crowned Finchlark
68. <i>Ammomanes phoenicurus</i>	Rufous-tailed Finchlark
69. <i>Galerida malabarica</i>	Malabar Crested Lark
70. <i>Mirafra erythroptera</i>	Red-winged Bushlark
71. <i>Alauda gulgula</i>	Eastern Skylark
72. <i>Hirundo concolor</i>	Dusky Crag Martin
73. <i>Hirundo rustica</i>	Eastern Swallow
74. <i>Hirundo daurica</i>	Red-rumped Swallow
75. <i>Hirundo smithii</i>	Wire-tailed Swallow
76. <i>Lanius vittatus</i>	Bay-backed Shrike
77. <i>Lanius schach</i>	Rufous-backed Shrike
78. <i>Lanius excubitor</i>	Grey Shrike
79. <i>Oriolus oriolus</i>	Indian Oriole
80. <i>Dicrurus adsimilis</i>	Black Drongo
81. <i>Sturnus pagodarum</i>	Brahminy Myna
82. <i>Sturnus roseus</i>	Rosy Pastor
83. <i>Acridotheres tristis</i>	Common Myna
84. <i>Acridotheres fuscus</i>	Jungle Myna
85. <i>Corvus splendens</i>	House Crow
86. <i>Corvus macrorhynchos</i>	Jungle Crow
87. <i>Coracina melanoptera</i>	Black-headed Cuckoo-shrike
88. <i>Pericrocotus cinnamomeus</i>	Small Minivet
89. <i>Aegithina tiphia</i>	Common Iora
90. <i>Pycnonotus jocosus</i>	Red-whiskered Bulbul
91. <i>Pycnonotus cafer</i>	Red-vented Bulbul

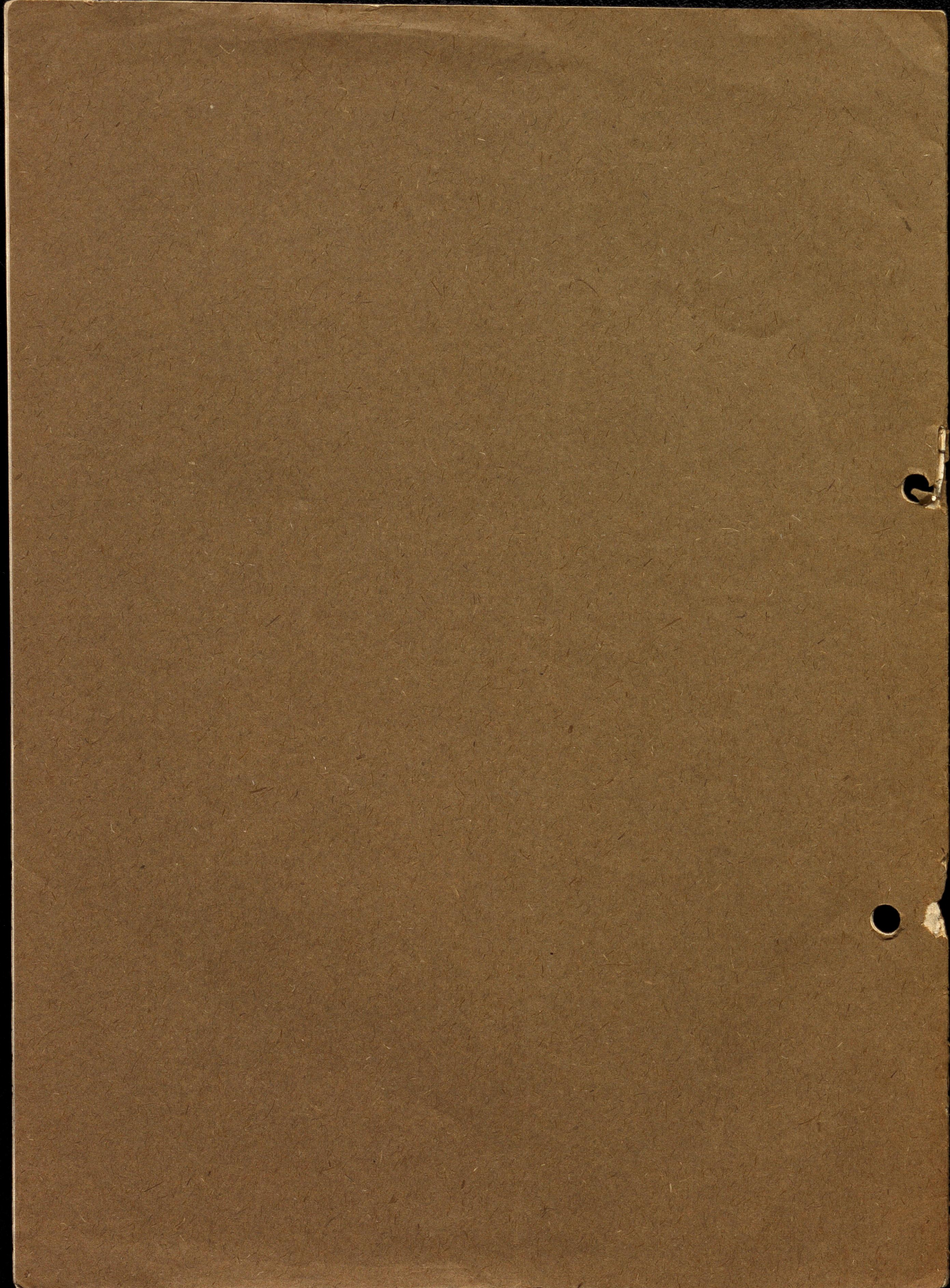
BIRD COUNT IN POONA

Scientific Name	English Name
92. <i>Turdoides malcolmi</i>	Large Grey Babbler
93. <i>Turdoides striatus</i>	Jungle Babbler
94. <i>Chrysomma sinensis</i>	Yellow-eyed Babbler
95. <i>Muscicapa parva</i>	Red-breasted Flycatcher
96. <i>Rhipidura aureola</i>	White-browed Fantail Flycatcher
97. <i>Cisticola juncidis</i>	Streaked Fantail Warbler
98. <i>Prinia subflava</i>	Indian Wren Warbler
99. <i>Prinia socialis</i>	Ashy Wren Warbler
100. <i>Orthotomus sutorius</i>	Tailor Bird
101. <i>Acrocephalus stentoreus</i>	Great Reed Warbler
102. <i>Acrocephalus dumetorum</i>	Blyth's Reed Warbler
103. <i>Prinia hodgsonii</i>	Franklin's Wren Warbler
104. <i>Phylloscopus trochiloides</i>	Greenish Leaf Warbler
105. <i>Sylvia curruca</i>	Lesser Whitethroat
106. <i>Erithacus svecicus</i>	Blue-throat
107. <i>Copsychus saularis</i>	Magpie Robin
108. <i>Saxicola caprata</i>	Pied Bushchat
109. <i>Saxicola torquata</i>	Stone Chat
110. <i>Saxicoloides fulicata</i>	Indian Robin
111. <i>Oenanthe deserti</i>	Desert Wheatear
112. <i>Monticola solitarius</i>	Blue Rock Thrush
113. <i>Phoenicurus ochrurus</i>	Black Redstart
114. <i>Parus major</i>	Grey Tit
115. <i>Anthus similis</i>	Brown Rock Pipit
116. <i>Anthus trivialis</i>	Tree Pipit
117. <i>Motacilla caspica</i>	Grey Wagtail
118. <i>Motacilla flava beema</i>	Blue-headed Yellow Wagtail
119. <i>Motacilla citreola</i>	Yellow-headed Wagtail
120. <i>Motacilla alba</i>	White Wagtail
121. <i>Motacilla maderaspatensis</i>	Large Pied Wagtail
122. <i>Dicaeum erythrorhynchos</i>	Tickell's Flowerpecker
123. <i>Nectarinia zeylonica</i>	Purple-rumped Sunbird
124. <i>Nectarinia asiatica</i>	Purple Sunbird
125. <i>Zosterops palpebrosa</i>	White-eye
126. <i>Passer domesticus</i>	House Sparrow
127. <i>Ploceus philippinus</i>	Weaver Bird
128. <i>Lonchura malabarica</i>	White-throated Munia
129. <i>Lonchura punctulata</i>	Spotted Munia
130. <i>Estrilda amandava</i>	Red Munia

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BIRDS OF DEFORESTED HILLS

PRAKASH GOLE

(*With two text-figures*)

BIRDS OF DEFORESTED HILLS¹

PRAKASH GOLE²

(With two text-figures)

The hills of Western Ghats south of Bombay (roughly between latitude 18°N to 19°N) present more or less a very barren aspect. Large trees or groves of trees are few and far between and extensive tracts even lack shrubbery. During the rainy season these hills are covered with grass but as the dry season is ushered in, grazing and lack of moisture take their toll, grass withers, shrubs wilt and the soil is exposed to the full impact of the sun and the wind. Just before the rainy season, dried grasses are set afire presumably in the hope of getting a luxuriant cover of grass once again.

Rainfall in these hills ranges from 9000 mm to 2000 mm per year and decreases rapidly from west to east. In spite of a prolonged dry season which lasts roughly from October to May, the annual rainfall appears to be sufficient to cover these hills with a varied forest, yet the hills present a barren aspect today.

When and how the process of deforestation of these hills began is nowhere documented in detail. The process might have begun in the closing years of the last century and gradually gathered momentum. For, in the nineteen-thirties one Mr. Garland, a forest officer, in his working plan of Pune District has expressed surprise in finding these hills so barren and bereft of trees (Garland 1934). It means that even more than fifty years ago these hills lacked tree-cover to any appreciable extent.

What could be the causes that led to deforestation of these hills? The same forest officer's remarks are interesting enough. He says, "In the west (i.e. in Western Ghats) the main influence of man appears to be due to shifting cultivation and in the east due to grazing and cutting for fuel and house timber. Burning for obtaining a grass crop is also evident wherever rainfall is above or about 70 cm." (Garland, loc. cit.). These remarks aptly describe the conditions in Western Ghats in the area which I have been studying for the last two years. This area is the 120.80 sq. km. catchment area of the Panshet dam located about 42 km to the west of Pune city. The Panshet reservoir supplies drinking water to the city as well as irrigation to the areas further to south-east in the direction of Solapur. The dam is built on the river Ambi which is a tributary of the river Mutha which flows through Pune city. The Ambi originates near Dapsar on the main ridge of Western Ghats at a height of about 1200 metres. It flows west through the hills for a distance of about 30 km to Panshet where its valley is reduced to a narrow neck facilitating the construction of the dam.

Before the dam was built the peasants of the Ambi valley cultivated rice on the valley floor which was fertile and practised shifting cultivation on the lower and middle slopes of the surrounding hills by clearing the vegetation but sparing such economically important trees as mango (*Mangifera indica*) and Hirda (*Terminalia chebula*). Forest of moist deciduous

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BUTTERFLIES OF THE NILGIRI MOUNTAINS

to semi-evergreen type of trees was mainly restricted to upper hill slopes and was categorised as reserve forest. Due to lack of transport facilities these forests were not worked. But when it was decided to construct the dam, a road was built to link Panshet with Pune. As the valley floor was going to be submerged the cultivators sold off the trees standing on their lands to timber and charcoal merchants of Pune who could cart away the wood in trucks thanks to the construction of the road. The contractors from the city even bought out the trees on lower and middle slopes leading to their almost complete deforestation (Gadgil 1979). The people whose lands were submerged under the reservoir were asked to resettle on the stony, dry plateaus near Dhond south-east of Pune near the end of the command area. Many of them returned to Panshet catchment, being unable to adjust to the new surroundings and populated the slopes above the reservoir level where they began the age-old practice of shifting cultivation for hill millets, and became dependent on this type of cultivation having lost their paddy fields under the reservoir. They even encroached upon the reserve forest areas for their fuel needs, timber and to a lesser extent for grazing their cattle. Consequently most of the reserve forest areas have been cut up and burnt. The only redeeming feature in this picture of deforestation is the presence of certain sacred groves which are dedicated to tribal deities and are not to be overtly cut.

Physical Character of the Hills:

The hills of the Panshet catchment area form part of the great trap region of the Deccan Plateau. The general aspect of the hills is very rugged and much cut up by gorges and ravines, through which a number of streams, many of them only seasonal, flow. Beyond Dapsar (see Fig. 1) near the western end of the catchment,

the descent to the Konkan from the main ridge of the Ghats, is abruptly precipitous. But to the east the hills taper off gradually, though till Panshet their character remains fairly rugged and difficult of access.

Basalt or Deccan trap which is the result of volcanic lava flows, occupies the hills in the catchment area. It is normally dark grey or blue grey in colour. The rock weathers into a disintegrated form known as *Murrum* and finally produces soils of varying depth, texture and colour. The red soils are common in these hills. They are generally shallow and coarse and often spoilt by a mixture of gravel. Soils produced from *Murrum* mostly lack in humus, are non-acid and naturally well-drained by the under-lying *murrum*.

The Western Ghats present a formidable barrier to the monsoon winds that come in from south-west after collecting a lot of moisture over the Arabian sea. Thus during the rainy season the effect of the ridge of Western Ghats on the western boundary is not only to cause excessive precipitation on the ridge itself, but also to create a rain-shadow to leeward side so that there is an amazingly sudden drop in rainfall on the eastern side. This is well illustrated by the rainfall data given in Table 1.

In the table the year 1960 was the year when the dam was almost complete and water was impounded for the first time. I began the present study in July 1983 and the other years in the table present rainfall data of the period just preceding the year 1983. The four rain-gauges are located to the west of the dam site, i.e. Panshet is near the dam site; Shirkoli and Mangaon are respectively further to the west and Dapsar is at the western end of the catchment, just below the crest-line of the main ridge.

It will be seen from Table 1 that village Dapsar which is situated near the western end

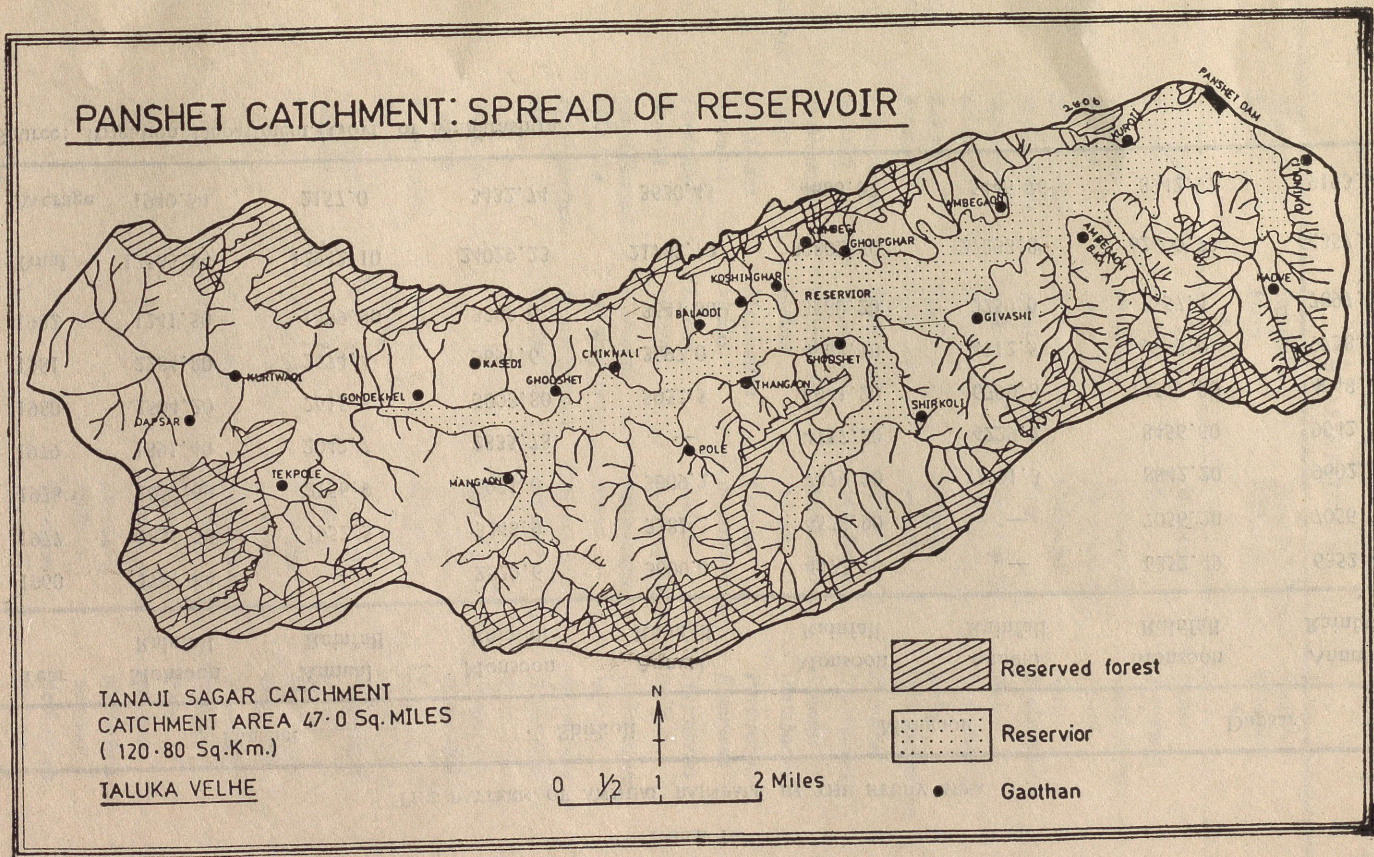


Fig. 1.

TABLE 1

THE PATTERN OF ANNUAL RAINFALL IN THE STUDY AREA

Year	Panshet		Shirkoli		Mangaon		Dapsar	
	Monsoon Rainfall	Annual Rainfall	Monsoon Rainfall	Annual Rainfall	Monsoon Rainfall	Annual Rainfall	Monsoon Rainfall	Annual Rainfall
1960	1787.64	—	2829.6	3000.0	4473.70	—	6352.49	6352.49
1977	1816.70	1952.5	3348.9	3381.2	4528.90	—	7056.20	7056.20
1978	2057.60	2156.9	2931.0	3009.2	7479.20	7501.3	8842.20	9602.40
1979	1891.40	2042.7	2835.73	—	4117.20	4229.2	8456.60	9042.60
1980	2504.20	2615.7	5003.80	5052.5	6941.20	6790.8	14577.90	14648.80
1981	2284.80	2674.4	3691.6	3697.0	4682.10	4712.5	9758.0	9758.0
1982	1241.50	1499.90	3388.6	3641.80	3580.20	3750.0	7557.4	7897.0
Total	13583.84	12942.10	24029.23	21782.70	32802.50	27233.8	62600.79	64357.49
Average	1940.54	2157.0	3432.74	3630.45	4686.07	5446.76	8942.97	9193.92

Source: Irrigation Department, Govt. of Maharashtra.

of the catchment, experiences an average annual rainfall of 9193 mm. Further east at Mangaon and Shirkoli the average annual rainfall drops to 5446 mm and 3630 mm respectively. While still further east at Panshet the annual average drops to 2157 mm. As said above the dry season begins in October and continues till the end of May during which temperatures vary between 17°-18°C to 35°-37°C. In the absence of biotic interference the character of vegetation and birds should correspond to the climatic conditions. In such climatic conditions the character of vegetation in the catchment may probably vary from dry deciduous in the east to evergreen in the extreme west where the rainfall is the highest. However, biotic disturbances make it difficult to identify natural climax vegetation. It can only be guessed from a study of the vegetation of groves sacred to temples as vegetation in these sacred groves has remained more or less undisturbed over a considerable period of time, and of forest patches found in certain inaccessible situations. The varied nature of vegetation existing over the remainder of the catchment may also help in this guesswork. Likewise the bird-life of sacred groves and that found in remote forest patches may provide clues to the character of bird-life that should prevail in this region in the absence of biotic interference. But before we consider the character of vegetation in greater detail, it will be convenient for our purposes to divide the study area into smaller manageable segments.

The Three Zones:

Three factors namely, the rainfall, the character of vegetation and the degree of influence of biotic factors, have been taken into account in dividing the catchment into three zones. The first zone extends from the dam site to village Givashi (see Fig. 2) on the right bank of the river Ambi and Ambegaon

Khurd on its left bank. This zone with an annual average rainfall between 2000 and 3000 mm has been subjected to maximum pressure from biotic factors and presents a denuded and devastated aspect. The second zone extending westwards from Ambegaon Khurd and Givashi and reaching Kasedi on the left and Mangaon on the right bank, bears an average annual rainfall of 3100 to 6000 mm and may be termed as a buffer zone between the low rainfall first zone and the high rainfall third zone, lying still to the west. The third or the last zone which includes the source region of the river Ambi stretches westward from Mangaon and Kasedi to the crest-line of the main ridge of the Western Ghats. The annual average rainfall in this zone ranges between 6001 mm to over 9000 mm.

Vegetation of the Three Zones:

The first zone presents an aspect of intense devastation and denudation. As biotic influences are severe, a sub-climax with grasses as dominants and only scattered trees and shrubs has become established. Only a few mango trees are left standing and lands lying fallow have been run over by *Lantana camara* and less nutritive grasses like *Themeda quadravulvis* and *Heteropogon contortus*. The next in dominance is *Terminalia tomentosa*. But the stability of associations among the sub-climax especially the grasses, can be easily disturbed. Fires and variation of grazing and cutting incidence result in a constant series of sub-series. Other plants occurring in this zone include *Carissa congesta*, *Lasiosiphon eriocephalus* and *Vitex negundo*. As reserve forests have mostly been cut up *Lantana* has invaded these areas also. *T. tomentosa* and climbers like *Dioscorea pentaphylla* and shrubs like *Solanum indicum* are the other plants commonly found in this zone. There are perhaps more trees around villages than in rest of the area of this

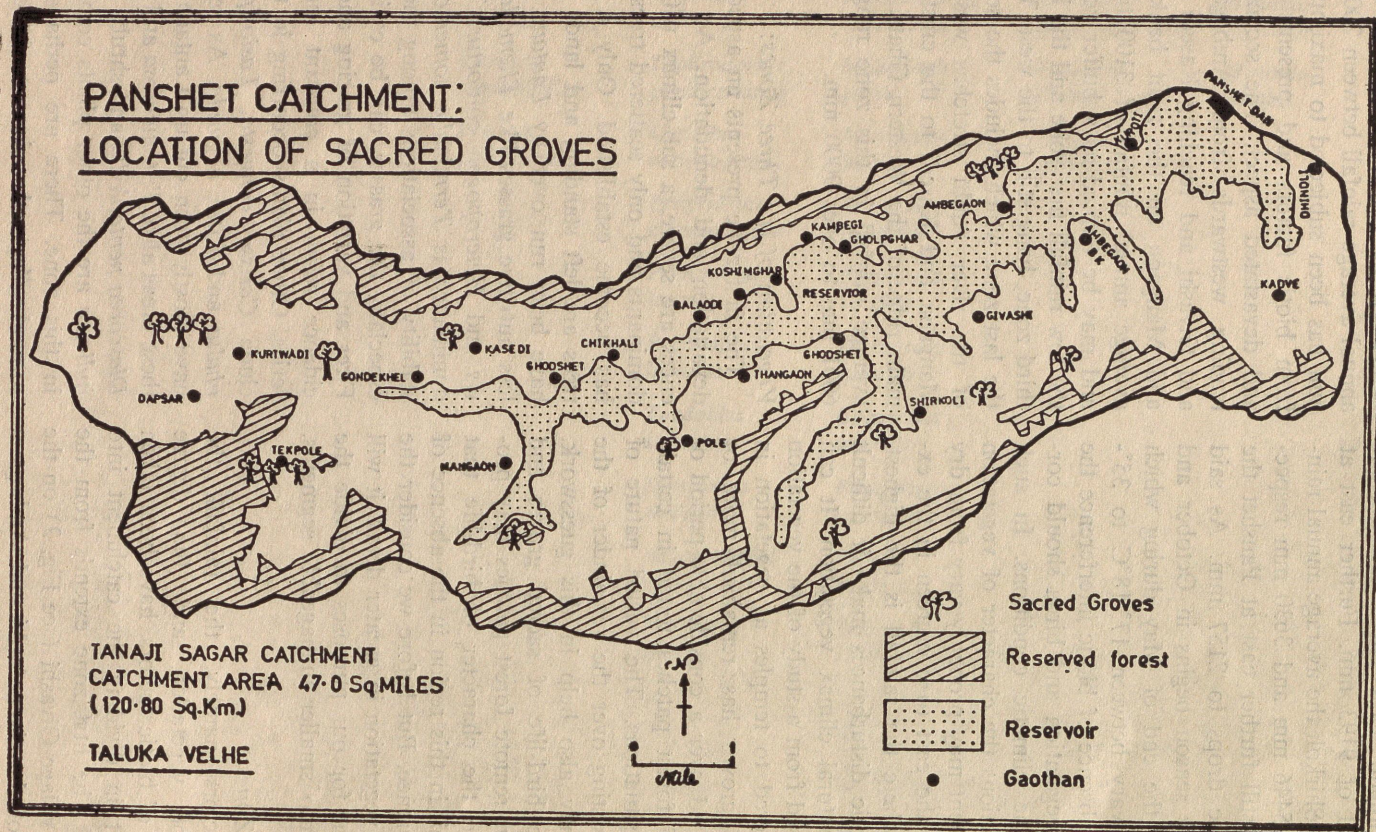


Fig. 2.

zone. They are mostly fruit trees such as mango and banana planted by the villagers. Here and there lone examples of *Alstonia scholaris*, *Salmalia malabarica* and *Erythrina variegata* stand as mute testimony to days gone by when the land was less intensely cultivated and conditions were moister.

The fallow period is as short as one year and slopes are cultivated almost annually in the first zone. As soil becomes exposed to wind and rain, it is quickly lost. Where erosion is particularly severe, rock is exposed and stony plateaux are the result. The slopes where erosion is less support grasses like *Themeda* and *Heteropogon* and herbs like *Smithea hirsuta*, *S. setulosa*, *Celosia argentea* and *Alysicarpus vaginalis*. These stony and grassy patches were seen to support their characteristic bird life too.

Near the western extremity of this zone on the right bank lies the Sacred Grove of Ambe-gaon Khurd. Vegetation in this grove remains more or less undisturbed over a number of years and may be said to exhibit vegetation typical of this zone if biotic influences did not have their full play. *Terminalia tomentosa*, *Vanqueria spinosa*, *Phyllanthus emblica*, *Bridelia retusa*, *Lagerstroemia microcarpa*, *Ficus glomerata*, *Bombax ceiba*, *Bauhinia racemosa*, *Cassia fistula*, *Albizia procera* and *Randia dumetorum* are some of the trees commonly occurring in this grove. As will be seen later the grove harbours its peculiar bird-life also.

Grassy plateaux are not extensive in the second or the middle zone; though wherever they exist the dominant grasses are not different from those found in the first zone. The fallow period is longer in the second zone and the patches lying fallow for more than a year quickly lose their character as grassy plateau and are occupied by plants next in biological succession. *Lantana camara* has invaded areas in this zone also though not as much as in

the first zone and is closely followed by *Carissa congesta*, *Meynea laxiflora*, *Lasiosiphon eriocephalus*, *Woodfordia fruticosa*, *Zizyphus rugosa*, *Emblica officinalis*, and *Syzygium cumini*. Around cultivated patches there are more trees left standing in this zone than in the first zone. Such trees include *Melia composita*, *Bridelia retusa*, *Erythrina indica*, *Butea monosperma*, *Terminalia tomentosa*, *Lagerstroemia microcarpa*, *Albizia procera*, *Cassia fistula* etc. Around hamlets the fruit trees include mango, jackfruit and banana. Besides there are extensive thickets of Bamboo (*Dendrocalamus strictus*) which form a major source of income for the villagers. *Syzygium cuminii* and *Ficus glomerata* also occur commonly around hamlets.

There are certain areas in this zone which have remained fallow for more than five to seven years and thus support some characteristic vegetation. Here plants include *Vanqueria spinosa*, *Wrightia tinctoria*, *Randia dumetorum*, *Ficus retusa* *Olea dioica* etc. Here also shrubs and climbers such as *Strobilanthes callosus*, *Randia malabarica*, *Crotalaria triquetra*, *Jasminum malabaricum*, *Flacourtia latifolia* and *Pavetta indica* have enveloped the trees and have provided a peculiar habitat for birds. Steeper slopes are dominated by *Strobilanthes callosus* and *Ficus rumphii*, while reserve forest areas which are less cut up in this zone than in first, are dominated by *T. tomentosa* and *Strobilanthes*. Other plants found in these areas are *Actinodaphne hookeri*, *Carissa congesta*, *Embelia tsjeriam-cottam*, *Lasiosiphon eriocephalus*, *Xeromphis spinosa* etc. Some magnificent specimens of *Bombax ceiba*, *Alstonia scholaris*, *Terminalia belerica* and *Terminalia chebula* still remain in the more remote and inaccessible areas. Near Mangaon on the left bank and near the western end of this zone, lies the Sacred Grove dedicated to the deity *Janni*. Spread over an area of more than 16 ha

this grove provides refuge to a number of trees as well as displays a characteristic bird-life of its own. Trees commonly occurring in this grove include *Bombax ceiba*, *Terminalia belerica*, *T. chebula*, *Sterculia guttata*, *Memecylone edule*, *Acacia concinna*, (climber) *Actinodaphne hookeri*, *Macaranga peltata*, *Caryota urens*, *Mappia foetida* etc.

The vegetation of the third zone with its very high annual rainfall presents a peculiar aspect. Ideally, in the absence of biotic interference, evergreen forest should be the climatic climax in this zone. However, biotic influences coupled with a long dry period are factors adverse to the existence of a pure evergreen crop. A series of sub-climaxes is the inevitable result. In lands lying fallow for less than five years, while no plant could exert as much dominance as *Lantana camara* in the first zone, the following plants were found to be common: *Woodfordia fruticosa*, *Strobilanthes callosus*, *Carissa congesta*, *Embelia tsjeriam-cottam*, *Lasiosiphon eriocephalus*, and *Glochidion hohenackeri*. Where erosion is heavy and rock is exposed *Euphorbia nerifolia* has become established. Where the soil is poor and shallow a dwarf type of forest forms a sub-climax in which *Memecylone edule* remains dominant. *Syzygium cuminii* and *Actinodaphne hookeri* dominate in areas which are under some degree of protection. The hamlets in this zone, as in the middle, remain concealed among lush growth of Bamboo and fruit trees such as *Syzygium cuminii* and mango. There are sacred groves in this zone also though not as large as in the middle zone. For example, in the group of three sacred groves at Dapsar the plants commonly found include *Entada scandens*, *Mappia foetida*, *Actinodaphne hookeri*, and *Ficus sp.*

Bird-life in the Three Zones:

The character of vegetation should reflect

the character of bird-life. Broadly speaking, the character of bird-life depends upon the availability of habitat. But in these hills a general lack of vegetation density and of botanical variety have restricted the availability of habitat. Human practices like shifting cultivation, cutting and burning of vegetation for clearing the ground and for making coal have created tension zones and disturbances which are not likely to be favourable to the existence of a varied avifauna. Further the valley floor stands submerged under a large and deep sheet of water. Water of considerable depth, steeply sloping and often rocky banks and lack of protective vegetation along the shoreline are also not conducive to birds. On this background therefore, the character of bird-life of these deforested hills has to be examined.

Very few birds were encountered on the deep, open sheet of water of the reservoir. A few Spotbill ducks, an occasional Little and a Large Cormorant and once a Blackheaded Gull were seen on the reservoir. As the reservoir water is let out during the dry season (usually from December onwards) and the water level goes down, Little and Median egrets, Common Sandpipers and Little Stints come to forage near the edges of water and the rapidly drying up mudflats. Common and Pied Kingfishers, Grey and Large Pied wagtails are also normally to be found along the water's edge. Whitenecked Storks and an Osprey have also been noted in sheltered bays and inlets of the reservoir. However, many other species that frequent aquatic and semi-aquatic habitats in the plains were never encountered in the catchment. It appears therefore, that these deep, open sheets of water in the mountains are not much favoured by birds presumably because they do not provide adequate food and shelter.

BIRDS OF DEFORESTED HILLS

Birds in the I Zone:

It may be recalled that in this zone due to severe biotic pressures forests have been replaced by such habitat-types as thorn and scrub, rocky and grassy plateau, scattered trees and cultivation and village environs. In addition there were certain birds that were always observed only in flight. The sacred grove near Ambegaon Khurd constitutes a distinct habitat also. Table 2 sets out the distribution of birds recorded in zone I according to broad habitat-types.

In this table a particular habitat is assigned to a bird species if it is frequently encountered in it. This does not mean it can never be seen in other habitat-types. Indeed birds such as Pond heron, Redwattled lapwing, Common green bee-eater, Little brown dove, Redvented and Redwhiskered bulbuls, Jungle babbler, Jungle crow, Indian robin and Pied bush chat were seen to be widely distributed in the catchment and were sometimes encountered in other habitats also.

It is seen from the table that out of the total number of 89 species recorded in this zone, the comparatively undisturbed area of the sacred grove appears to harbour less than 10% only. These may be said to indicate avifauna that was once typical of this zone. As biotic influences have eliminated most of the dry deciduous to moist deciduous types of forest, the birds characteristic of these biotopes have disappeared also. As xerophytic conditions are created birds belonging to stony, barren, thorn and scrub types of habitat have invaded this zone. Such species now constitute about 45% of the total avifauna recorded in this zone. These species perhaps indicate the degree of degradation of habitat from an idyllic state dictated solely by environmental conditions. The complete disappearance of birds belonging to moist deciduous biotope

may also provide another indication of the degradation of the habitat.

Birds in the II Zone:

Table 3 likewise shows the distribution of birds in the second or middle zone. The table shows that this zone is far richer in birds than the first. The highest number of species are from the habitat, 'trees interspersed with shrubs' followed by those from 'trees' and 'sacred groves'. If species recorded in the sacred grove are to be considered as typical of this zone, their percentage in the total recorded number is 12 only; i.e. species belonging to moist deciduous and semi-evergreen biotopes have been reduced to 12%. Species from dry deciduous and to a lesser extent open, thorn and scrub types of habitat seem to have invaded this zone due to biotic pressures. However, these pressures do not appear to be strong enough to reduce to insignificance the species from moist deciduous and semi-evergreen biotopes. Neither do they seem to be restricted to sacred groves only. Outside sacred groves such species have been recorded from 'trees interspersed with shrubs' and 'trees and village environs'. Indeed the existence of scattered groups of trees, of lush vegetation around villages and of a large sacred grove in this zone appear to have contributed to the maintenance of many species that otherwise would have been eliminated. While the degree of degradation of the habitat in this zone may be gauged by the number of species belonging to more open and drier habitats, the process of degradation itself appears to have been arrested by certain conservation practices of the local people.

Birds in the III Zone:

The third zone again presents a very peculiar picture if its bird-life is examined. Table 4

TABLE 2

DISTRIBUTION OF BIRDS ACCORDING TO HABITAT IN ZONE I IN THE CATCHMENT OF PANSHET DAM

HABITAT TYPES

Aquatic 1	Rocky Plateau 2	Grassy Plateau 3	Thorny Scrub 4	Shrubs & Trees 5	Trees & Village Environs 6	Sacred Groves 7	Seen in Flight 8
<i>Phalacrocorax carbo</i>	<i>Coturnix coromandelica</i>	<i>Bubulcus ibis</i>	<i>Pardipula asiatica</i>	<i>Accipiter nisus</i>	<i>Columba livia</i>	<i>Galloperdix spadicea</i>	<i>Elanus caeruleus</i>
<i>Phalacrocorax niger</i>	<i>Pardipula argoondah</i>	<i>Circus macrourus</i>	<i>Merops orientalis</i>	<i>Butastur teesa</i>	<i>Streptopelia decaocto</i>	<i>Treron phoenicoptera</i>	<i>Milvus migrans govinda</i>
<i>Tringa ochropus</i>	<i>Vanellus indicus</i>	<i>Francolinus pictus</i>	<i>Lanius schach</i>	<i>Falco tinnunculus</i>	<i>Psittacula krameri</i>	<i>Psittacula cyanocephala</i>	<i>Gyps indicus</i>
<i>Tringa hypoleucos</i>	<i>Streptopelia senegalensis</i>	<i>Alauda gulgula</i>	<i>Pycnonotus cafer</i>	<i>Clamator jacobinus</i>	<i>Halcyon smyrnensis</i>	<i>Caprimulgus indicus</i>	<i>Gyps bengalensis</i>
<i>Ceryle rudis</i>	<i>Caprimulgus asiaticus</i>	<i>Cisticola juncidis</i>	<i>Chrysomma sinense</i>	<i>Taccocua leschenaultii</i>	<i>Dicrurus adsimilis</i>	<i>Megalaima viridis</i>	<i>Neophron percnopterus</i>
<i>Alcedo atthis</i>	<i>Mirafra erythroptera</i>	<i>Anthus similis</i>	<i>Turdoides caudatus</i>	<i>Lanius vittatus</i>	<i>Sturnus pagodarum</i>	<i>Tephrodornis pondicerianus</i>	<i>Spilornis cheela</i>
<i>Motacilla maderaspatensis</i>	<i>Eremopterix grisea</i>	<i>Estrilda amandava</i>	<i>Turdoides striatus</i>	<i>Pycnonotus jocosus</i>	<i>Acridotheres tristis</i>	<i>Pomatorhinus horsefieldii</i>	<i>Apus affinis</i>
	<i>Ammomanes phoenicurus</i>	<i>Emberiza buchanani</i>	<i>Prinia hodgsonii</i>	<i>Prinia socialis</i>	<i>Corvus macrorhynchos</i>	<i>Alcippe poioicephala</i>	<i>Hirundo concolor</i>
	<i>Galerida malabarica</i>		<i>Prinia subflava</i>	<i>Prinia sylvatica</i>	<i>Pericrocotus cinnamomeus</i>	<i>Terpsiphone paradisi</i>	<i>Hirundo rustica</i>
	<i>Saxicola torquata</i>		<i>Sylvia curruca</i>	<i>Acrocephalus dumetorum</i>	<i>Aegithina tiphia</i>		<i>Hirundo smithii</i>
	<i>Monticola solitarius</i>		<i>Phylloscopus collybita</i>	<i>Turdus merula</i>	<i>Anthus trivialis</i>		<i>Hirundo daurica</i>
	<i>Motacilla alba</i>		<i>Phylloscopus sp.</i>	<i>Lonchura punctulata</i>	<i>Passer domesticus</i>		
	<i>Melophus lathami</i>		<i>Lonchura malabarica</i>		<i>Ploceus philippinus</i>		

TABLE 3

DISTRIBUTION OF BIRDS ACCORDING TO HABITAT IN ZONE II IN THE CATCHMENT OF PANSHET DAM

Aquatic	Grassy Plateau	Thorny Scrub	Shrubs & Trees	Trees & Village Environs	Sacred Groves	Seen in Flight
1	2	3	4	5	6	7
<i>Ardeola grayii</i>	<i>Bubulcus ibis</i>	<i>Turnix suscitator</i>	<i>Accipiter badius</i>	<i>Amaurornis phoenicurus</i>	<i>Spilornis cheela</i>	<i>Elanus caeruleus</i>
<i>Egretta intermedia</i>	<i>Circus macrourus</i>	<i>Streptopelia senegalensis</i>	<i>Accipiter nisus</i>	<i>Columba livia</i>	<i>Chalcophaps indica</i>	<i>Pernis ptilorhynchus</i>
<i>Egretta garzetta</i>	<i>Coturnix coromandelica</i>	<i>Merops orientalis</i>	<i>Falco tinnunculus</i>	<i>Streptopelia chinensis</i>	<i>Otus bakkamoena</i>	<i>Spizaetus cirrhatus</i>
<i>Ciconia episcopus</i>	<i>Vanellus indicus</i>	<i>Lanius schach</i>	<i>Perdica asiatica</i>	<i>Psittacula krameri</i>	<i>Bubo bubo</i>	<i>Hieraetus pennatus</i>
<i>Pandion haliaetus</i>	<i>Upupa epops</i>	<i>Pycnonotus cafer</i>	<i>Galloperdix spadicea</i>	<i>Eudynamis scolopacea</i>	<i>Dicrurus leucophaeus</i>	<i>Aquila rapax</i>
<i>Tringa ochropus</i>	<i>Galerida malabarica</i>	<i>Turdoides striatus</i>	<i>Treron phoenicoptera</i>	<i>Centropus sinensis</i>	<i>Sturnus malabaricus</i>	<i>Gyps indicus</i>
<i>Tringa hypoleucos</i>	<i>Alauda gulgula</i>	<i>Prinia subflava</i>	<i>Psittacula phoenicoptera</i>	<i>Athene brama</i>	<i>Pericrocotus flammeus</i>	<i>Gyps bengalensis</i>
<i>Calidris minuta</i>	<i>Cisticola juncidis</i>	<i>Prinia sylvatica</i>	<i>Cuculus micropterus</i>	<i>Halcyon smyrnensis</i>	<i>Hypsipetes madagascariensis</i>	<i>Falco peregrinus</i>
<i>Alcedo atthis</i>	<i>Motacilla alba</i>	<i>Phylloscopus collybita</i>	<i>Caprimulgus indicus</i>	<i>Megalaima haemaccephala</i>	<i>Pellorneum ruficeps</i>	<i>Apus melba</i>
<i>Myiophonus horsefieldii</i>		<i>Phylloscopus sp.</i>	<i>Megalaima viridis</i>	<i>Oriolus oriolus</i>	<i>Alcippe poioicephala</i>	<i>Apus affinis</i>
<i>Motacilla cinerea</i>		<i>Saxicola caprata</i>	<i>Lanius vittatus</i>	<i>Sturnum pagodarum</i>	<i>Culicicapa ceylonensis</i>	<i>Hemiprocne longipennis</i>
<i>Motacilla maderaspatensis</i>		<i>Saxicoloides fulicata</i>	<i>Acridotheres fuscus</i>	<i>Corvus macrorhynchos</i>	<i>Hypothymis azurea</i>	<i>Hirundo rupestris</i>

TABLE 3 (contd.)

Aquatic 1	Grassy Plateau 2	Thorny Scrub 3	Shrubs & Trees 4	Trees & Village Environs 5	Sacred Groves 6	Seen in Flight 7
		<i>Nectarinia asiatica</i>	<i>Aegithina tiphia</i>	<i>Pomatorhinus horsefieldii</i>	<i>Monticola cinclorhynchus</i>	<i>Hirundo concolor</i>
		<i>Petronia xanthocollis</i>	<i>Tephrodornis pondicerianus</i>	<i>Muscicapa parva</i>	<i>Zoothera citrina</i>	<i>Hirundo smithii</i>
		<i>Ploceus philippinus</i>	<i>Coracina melanoptera</i>	<i>Muscicapa pallipes</i>	<i>Anthus trivialis</i>	
			<i>Pericrocotus cinnamomeus</i>	<i>Muscicapa tickelliae</i>		
			<i>Pycnonotus jocosus</i>	<i>Rhipidura aureola</i>		
			<i>Pycnonotus luteolus</i>	<i>Orthotomus sutorius</i>		
			<i>Turdoides subrufus</i>	<i>Copsychus saularis</i>		
			<i>Muscicapa thalassina</i>	<i>Phoenicurus ochruros</i>		
			<i>Acrocephalus dumetorum</i>	<i>Parus major</i>		
			<i>Turdus merula</i>	<i>Parus xanthogenys</i>		
				<i>Dicaeum agile</i>		
				<i>Dicaeum erythrorhynchus</i>		
				<i>Zosterops palpebrosa</i>		
				<i>Lonchura punctulata</i>		

BIRDS OF DEFORESTED HILLS

TABLE 4

DISTRIBUTION OF BIRDS ACCORDING TO HABITAT IN ZONE III IN THE CATCHMENT OF PANSHET DAM
HABITAT TYPES

Aquatic 1	Thorny Scrub 2	Shrubs & Trees 3	Trees & Villages Environs 4	Sacred Groves 5	Seen in Flight 6
<i>Ardeola grayii</i>	<i>Perdicula asiatica</i>	<i>Accipiter badius</i>	<i>Bubulcus ibis</i>	<i>Gallus sonneratii</i>	<i>Elanus caeruleus</i>
<i>Anas poecilorhyncha</i>	<i>Vanellus indicus</i>	<i>Accipiter nisus</i>	<i>Amaurornis phoenicurus</i>	<i>Chalcophaps indica</i>	<i>Pernis ptilorhynchus</i>
<i>Larus ridibundus</i>	<i>Streptopelia senegalensis</i>	<i>Spilornis cheela</i>	<i>Columba livia</i>	<i>Otus bakkamoena</i>	<i>Spizaetus cirrhatu</i>
<i>Alcedo atthis</i>	<i>Merops orientalis</i>	<i>Falco tinnunculus</i>	<i>Streptopelia orientalis</i>	<i>Bubo zeylonensis</i>	<i>Ictinaetus malayensis</i>
<i>Myiophonus horsfieldii</i>	<i>Lanius schach</i>	<i>Galloperdix spadicea</i>	<i>Oriolus oriolus</i>	<i>Strix leptogrammica</i>	<i>Gyps indicus</i>
<i>Motacilla cinerea</i>	<i>Pycnonotus jocosus</i>	<i>Centropus sinensis</i>	<i>Sturnus pagodarum</i>	<i>Dicrurus leucophaeus</i>	<i>Gyps bengalensis</i>
<i>Motacilla maderaspatensis</i>	<i>Pycnonotus cafer</i>	<i>Caprimulgus indicus</i>	<i>Acridotheres fuscus</i>	<i>Sturnus malabaricus</i>	<i>Falco peregrinus</i>
	<i>Turdoides subrufus</i>	<i>Megalaima viridis</i>	<i>Corvus macrorhynchos</i>	<i>Pericrocotus flammeus</i>	<i>Apus melba</i>
	<i>Turdoides striatus</i>	<i>Lanius vittatus</i>	<i>Alcippe poioicephala</i>	<i>Hypsipetes indicus</i>	<i>Hemiprocnis longipennis</i>
	<i>Phylloscopus collybita</i>	<i>Coracina melanoptera</i>	<i>Muscicapa parva</i>	<i>Pellorneum ruficeps</i>	<i>Hirundo rupestris</i>
	<i>Phylloscopus sp.</i>	<i>Pomatorhinus horsfieldii</i>	<i>Muscicapa pallipes</i>	<i>Hypsipetes madagascariensis</i>	<i>Hirundo concolor</i>
	<i>Saxicola caprata</i>		<i>Muscicapa tickelliae</i>	<i>Culicicapa ceylonensis</i>	
	<i>Saxicoloides fulicata</i>	<i>Turdus merula</i>	<i>Rhipidura aureola</i>	<i>Terpsiphone paradisii</i>	
	<i>Nectarinia asiatica</i>	<i>Anthus trivialis</i>	<i>Orthotomus sutorius</i>	<i>Hypothymis azurea</i>	
		<i>Petronia brunneus</i>	<i>Erithacus brunneus</i>	<i>Monticola cinclorhynchus</i>	
		<i>Carpodacus erythrinus</i>	<i>Copsychus saularis</i>	<i>Zoothera citrina</i>	
			<i>Parus xanthogenys</i>	<i>Citta castanea</i>	
			<i>Dicaeum agile</i>	<i>Nectarinia minima</i>	
			<i>Dicaeum erythrorhynchos</i>	<i>Aethopyga siparaja</i>	
			<i>Zosterops palpebrosa</i>		

gives the distribution according to habitat in this zone.

It may be recalled that the average annual rainfall in this zone ranges between 6001 to 9000 mm. As such the zone should be clothed with semi-evergreen to evergreen forest. But biotic influences have reduced the vegetation to scattered trees and bushes. The sacred groves near villages Tekpowale and Dapsar are not as large as those near Ambegaon Khurd and Mangaon and they are the only masses of vegetation that now remain in this zone. Also some reserve forest area near the source of the river Ambi still remains more or less wooded. The number of species of birds recorded in this zone is far less than the number in the middle zone and is even marginally lower than the number from the first zone. Out of the total number of species recorded in this zone only 3 namely, Redwattled lapwing, Little brown dove and Indian robin may be properly said to represent thorn and scrub type of habitat. In spite of widespread availability of shrubby species from open and scrub type of biotope do not seem to be successful in colonising this zone. Species representing dry deciduous biotope also are less numerous than in the middle zone. While there are 43 species which may be said to represent moist deciduous to semi-evergreen biotope, species representing evergreen forest appear to be totally absent. Species like Nilgiri Wood Pigeon (*Columba elphinstonii*), Greyfronted Green Pigeon (*Treron pompadora*), Bluewinged Parakeet (*Psittacula columboides*) and Shama (*Copsychus malabaricus*) which occur in other protected areas in these hills, have disappeared from the catchment. Out of these 43 species 21 were found to be restricted to sacred groves only. They are likely to disappear if these groves are further disturbed. The role of large areas of undisturbed indige-

neous vegetation such as sacred groves in the maintenance of avifauna is thus again highlighted. The peculiar weather conditions prevailing in this zone may perhaps make it unfit for colonization by species from drier habitats

It therefore, appears that biotic influence has disturbed this sector to a greater extent than any other sector. The peculiar weather conditions in this zone, dominated as they are by the Western Ghats which are instrumental in bringing torrential rains into this area, have probably rendered the character of vegetation and bird life a specialised one. Only a restricted number of bird families appear to be able to adapt to these conditions and their food and habitat requirements may be typical. They quickly succumb if these are interfered with and other bird species, though their needs are less specialized, seem not to be very successful in colonising this area. The hills in this zone therefore, represent a very fragile eco-system which needs strict protection if its characteristic vegetation and bird life are to survive.

It may not be inappropriate to recapitulate here the main points that are made out in the above analysis:

1. In a particular area the extent to which the character of bird life differs from the one indicated by environmental conditions may point to the degree of deterioration of the habitat.
2. In certain areas climatic conditions and consequently the character of vegetation may be so specialised as to render biotic interference doubly destructive. On the one hand, biotic interference leads to elimination of certain specialized bird species through destruction of their habitat, on the

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other, the peculiar climatic conditions prevailing in the area may prevent the invasion by other bird species belonging to different biotopes. Such regions thus deserve a greater degree of protection to preserve the peculiar character of their avifauna. Here the character of bird life may provide an answer to the question why a particular region needs special protection.

3. Examination of the character of bird life of a particular region may bring out the importance of certain age-old practices that contribute to conservation of nature. Importance of indigenous vegetation in the maintenance of avifaunal diversity and richness is also brought out through the above analysis.

Conservation Implications:

The major destructive factor in these hills appears to be the practice of shifting cultivation. River valley projects in these hills have only forced the inhabitants to resort to such cultivation with a greater intensity. The sooner they are given alternative sources of income the better for hill flora and fauna.

In these hills sacred groves appear to be pools or islands of biological diversity in the midst of increasing impoverishment of the habitat. They should be carefully protected. Certain groves are being progressively destroyed due to erosion of religious sentiments and economic pressure; at some sites only a dilapidated temple under a large tree provides clue to the existence of a sacred grove. Such groves need to be identified by reestablishing their former boundaries and the whole area should be given protection to rehabilitate it.

The ridges with very high rainfall with their specialized flora and fauna need complete pro-

tection. These ridges also give birth to a number of our famous rivers that flow eastward and benefit millions who live on their banks in the plains. Complete protection will make the source regions of our important rivers inviolate. All these ridges should as such form part of a vast national park or protective zone that should run north-south along the entire length of the Western Ghats.

In the end, some general remarks regarding birds of deforested hills may not be out of place. A total of about 160 species of birds in an area of about 121 sq. km may be said to indicate a general paucity of birds. No comparable figures are available though it may be pertinent to note that areawise the number of species is far less than the number recorded in Pune city! (Gole 1980). If aquatic birds are excluded the proportion of bird species that feed on the ground and in low bushes appears to be high and reflects perhaps the scarcity of trees in these hills. In particular the complete absence of woodpeckers and hornbills is striking and perhaps reflects the lack of old mature trees in the hills. The variety of birds of prey may also be noted. It is probable that the widespread practice of shifting cultivation may invite rodents on a large scale which in turn attract birds of prey. Cultivators when asked, uniformly complained about the menace of rodents such as mice, rats and hares, and fields when examined at random for the presence of rodent burrows, revealed it not insubstantially. However, only the Crested serpent eagle was found to be nesting in these hills. Others are probably transients and cannot nest as suitable nesting trees are scarce. The paucity of game birds such as ducks and waders, partridges and junglefowls and pigeons and doves may also be noted. This denies local residents an important source of protein for which perhaps

they themselves are to blame. But it may also be added that with better management of the habitat it is possible to rehabilitate these species. Lastly, it may be interesting to note that commensals of man such as House crow, House sparrow and Common myna have not as yet penetrated these hills to any appreciable extent and their general absence provides a welcome change to the trekkers and observers of bird life that care to visit our hills.

ACKNOWLEDGEMENTS

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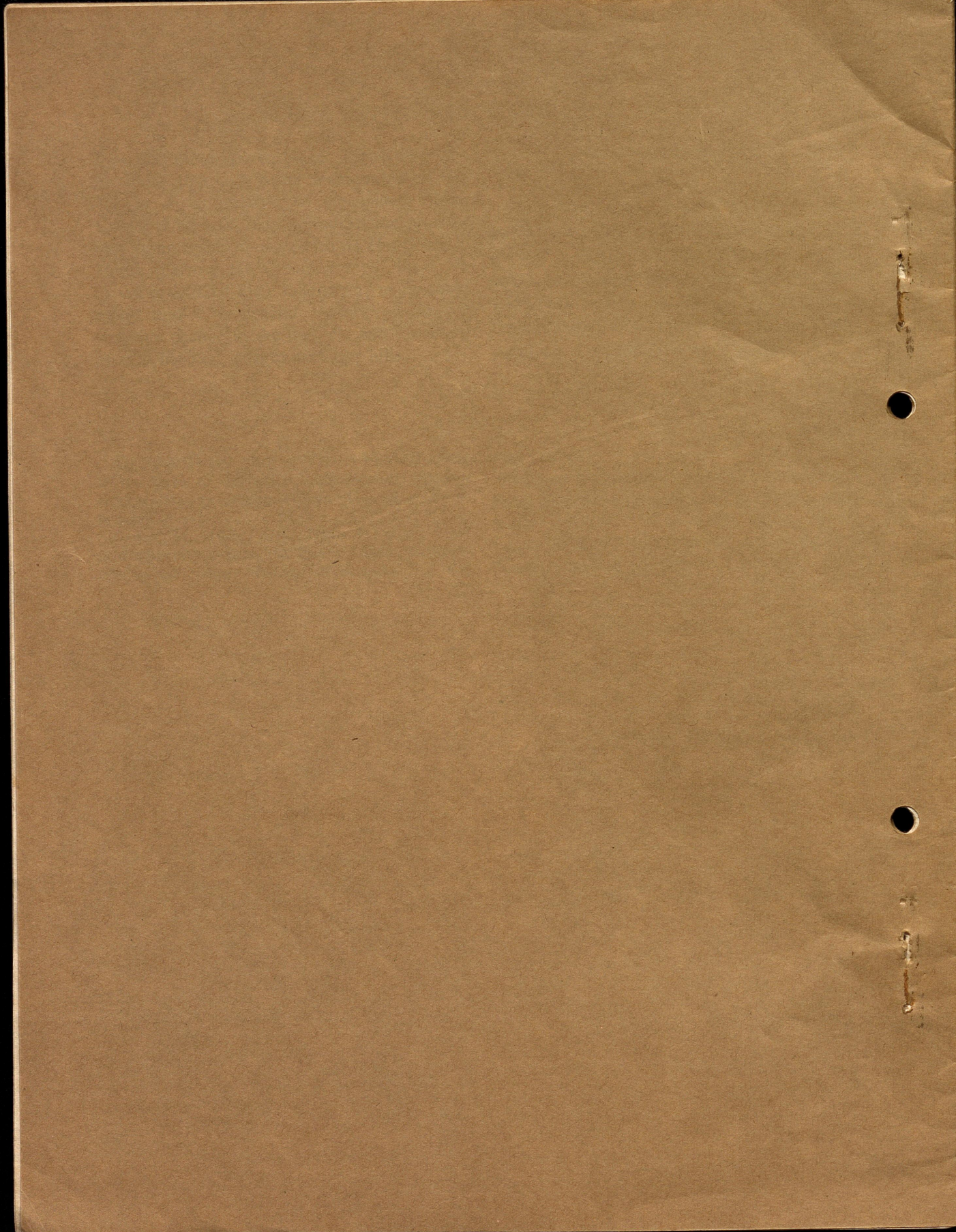
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BIRDS OF A POLLUTED RIVER

PRAKASH GOLE

BIRDS OF A POLLUTED RIVER¹

PRAKASH GOLE²

(With four text-figures & three maps)

The Mutha river meanders through Pune City for a distance of over 6.5 km from Vitthalwadi to the Southwest, to the Sangam in the northeast, before it merges into the Mula at the latter place. The joint stream then flows for a distance of 4 kilometres before it leaves the city-limits.

I have been watching birds along these stretches of the rivers for well over fifteen years, i.e. since the mid-sixties. This article however, while taking note of some of the major changes noted over all these years, is primarily based on systematic observations made over a period of over six months, i.e. from October 1982 to April 1983.

Special mention should be made of the tail-end portion of the Mula-Mutha, where the joint stream leaves the city-limits. This 1.5 km stretch of the Mula-Mutha now constitutes the Mula-Mutha Bird Sanctuary inaugurated by Dr. Sálím Ali in 1977. The Sanctuary deserves separate treatment on account of the numbers and variety of birds found there in winter and spring.

QUALITY OF RIVER-WATERS

It is generally believed that the water of both the rivers is polluted. Sewage overflows into the rivers at many points and industrial effluents

also drain into the rivers. To gauge the extent of pollution, water-samples were collected at many points along the river-course. For chemical analysis of water a five-litre sample was collected from each of the points and 250 cc samples were used for the MPN count. Tables 1A and 1B show results of the analysis of water-samples. The names of collection points are also given in the tables and the same can be seen on maps. To compare the quality of water of the rivers with that of other water-bodies, samples were also collected from the Khadakwasla reservoir upstream on the river Mutha and from Ambil Odha, a stream that meets the Mutha in the city.

It will be seen from Table 1A that as the river flows from Vitthalwadi to the Sangam the proportion of solids, Dissolved solids, COD, BOD and Chlorides goes on increasing which indicates that the river is receiving higher and higher loads of organic matter. This is due to the increase in the number of sewage overflows going into the river. The oxygen content is mostly low. The water of Ambil Odha which flows through densely populated areas and on whose banks a number of hutment colonies are located, brings into the river even greater loads of pollution. It is also worth noting that samples from the Mula and the Mula-Mutha also show a higher concentration of pollution and compare favourably with the Odha.

Table No. 1B shows the results of the MPN count. Predictably the analysis shows an in-

¹ Accepted May 1983.

² 1B Abhimanshree Housing Society, Pune 411 008, Maharashtra.

TABLE 1A

CHEMICAL AND BACTERIOLOGICAL ANALYSIS OF WATER SAMPLES COLLECTED AT DIFFERENT POINTS ALONG THE RIVERS IN PUNE CITY

Count of	No. of Collecting Stations along the Mutha, the Mula & the Mula-Mutha										Names of Stations
	1	2	3	4	5	6	7	8	9	10	
Turbidity (ppm)	07	16	06	12	11	09	14	11	08	15	1 = Khadakwasla Reservoir
Total Solids (mg/litre)	108	120	100	168	184	200	252	322	190	334	2 = Upstream of Vitthalwadi
Dissolved Solids (mg/l)	108	108	100	148	167	191	246	218	180	292	3 = Opp. Pumping Station
C O D	10	04	24	25	21	05	78	70	19	150	4 = Upstream of Garware Causeway
B O D	03	01	07	07	06	02	30	22	07	40	5 = Near Shinde Bridge
Dissolved Oxygen	4.20	1.40	4.60	4.20	5.20	4.30	2.90	2.40	1.30	3.0	6 = Upstream Denge Bridge
Nitrates (N205)	—	—	—	—	—	—	—	—	—	2	7 = Downstream Holkar Br. (on the Mula)
Nitrites (N203)	—	—	—	—	—	—	—	—	—	—	8 = Downstream Sangam Br. (on the Mula-Mutha)
Chlorides (Cl)	14	8	21	21	21	28	35	42	49.5	35	9 = In Bird Sanctuary 10 = In Ambil Odha

TABLE 1B

BACTERIOLOGICAL COUNT OF WATER COLLECTED AT DIFFERENT POINTS ALONG THE RIVERS IN PUNE CITY

M P N Results: Count per 100 ml of water		
Sample Collected at	Date	Count
1. Upstream of V. wadi	22.3.83	1.4×10^6
2. Opp. Pumping Station	25.3.83	2.0×10^5
3. Below Garware Causeway	22.3.83	2.5×10^6
4. Near Natraj Causeway	22.3.83	1.3×10^7
5. Below Omkareshwar Temple	22.3.83	1.3×10^7
6. Below Shivaji Bridge	22.3.83	3.5×10^8
7. Below the Sangam	6.4.83	1.5×10^5
8. In the Mula River	6.4.83	1.0×10^5
9. In Bird Sanctuary	24.3.83	3.5×10^7

creasing concentration of organisms per 100 ml as the river flows from Vitthalwadi to Sangam Bridge. The conspicuous rise in coliform MPN indicates faecal pollution. This makes the water highly dangerous to human beings and activities such as bathing, washing clothes and utensils, which are normally carried out by citizens on the river, are fraught with danger of infection. However, as will be seen from the discussion that follows, this water, which carries a great load of organic matter, may not necessarily be dangerous to birds. Indeed it appears that certain species of birds thrive on it.

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BROAD HABITAT-TYPES ALONG THE RIVER COURSE

The 6.5 km stretch of the Mutha and the further 4 km stretch of the Mula-Mutha exhibit a variety of habitats. They are : 1) Deep water; 2) Shallow water; 3) Marshy land; 4) Grassland; 5) Rocks and boulders, and 6) Dryland and scrub. Riverside trees also constitute a distinct habitat, though arboreal birds are not considered here. Let us now see the characteristic bird-life of each of these habitats. The broad extent of each of these habitats is shown in the maps.

DEEP-WATER HABITAT

The Mutha river within Pune city is shallow with an average depth of less than a metre. In certain places, however, deepish pools are formed, e.g. near Vitthalwadi, near Omkareshwar Temple, and near the Sangam. The Mula is a bigger river and the stretch between Holkar Bridge and Sangam is deeper (average depth about 2 metres). The joint flow below Sangam is of considerable depth too, due to impoundment near Bund Garden. The river-flow is again shallow in the Bird Sanctuary.

The common submerged plants occurring in this habitat are : *Hydrilla verticillata*, *Lemna gibba*, *Ceratophyllum demersum*, *Vallisneria spiralis*, *Spirodela polyrhiza* etc. *Eichhornia crassipes* became progressively dominant after October, especially in the Mula and by March it had almost covered the open water in the Bird Sanctuary. Another obnoxious weed *Pistia stratiotes* was also recorded at a few places especially on the Mula.

The characteristic bird of this habitat appears to be Little Grebe or Dabchik. Groups of these birds were seen at every place on the Mutha where there is deepish water.

The stretch of the Mula considered here does not hold any Dabchik perhaps due to lack of aquatic food and movement of boats in the river. Upstream of Garware causeway these birds were seen to breed from February onwards on little platforms made up of aquatic plants (*Hydrilla*) and floating debris. Three nests and a pair with two chicks were seen in the last week of February 1983.

Coots, Little Cormorants, a few Large Cormorants and ducks like Garganey Teals, Pintails and Shovellers were the other birds that belonged to this habitat. The Cormorants are a recent addition to the river fauna. The Little Cormorants started appearing on the river since 1969 and the Large ones came as recently as 1980. They perhaps reflect the abundance of small and medium-size fish in the river; fish that thrive on the nutrient-rich sewage water. It may be significant that the Cormorants were absent when the proportion of sewage in river-water was low, i.e. before the seventies. Do these fish-eaters indicate the quality of fish in the waterbody, in this case smaller fish? For, all the fishermen whom we asked about the quality of fish in the river, complained that good quality fish are no longer found in the river, except during a few days immediately after the monsoon. This aspect of the correlation between Cormorants and fish needs deeper investigation, however.

Ducks were concentrated in deepish pools in the Bird Sanctuary. Garganey Teals became numerous after 1972. They use the Sanctuary area during daytime for resting on rocks mid-stream and appear to feed on chironomus larvae and other floating insects. Over 800 were counted in early March 1983. Since 1970 an occasional Pintail used to be seen in the Sanctuary area. In the winter of 1982-83 their number was the highest recorded so far.

A few Shovellers with the colourful males outnumbering females are to be seen in the Sanctuary every winter. They feed on floating aquatic insects.

SHALLOW-WATER HABITAT

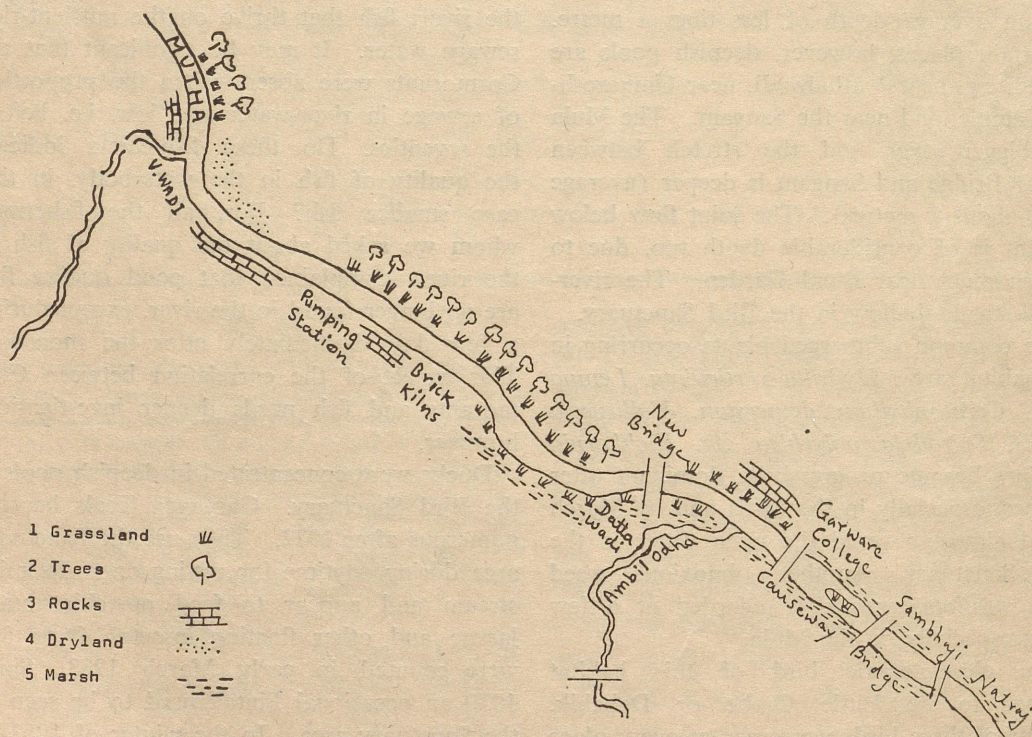
Most of the stretch of the Mutha river considered here, being shallow, this habitat covers probably the greater part of the river ecosystem. The water is shallow, at places even midstream, and there are rocky outcrops, islands, floating vegetation and other debris which the birds can take advantage of, while wading through shallow water.

Plants of this habitat include partly submerged plants, plants growing at the edge of

water and those growing along drains and other effluents flowing into the river. *Cryptocoryne retrospirallis*, *Xanthium strumarium*, *Ammania baccifera*, *Commelina* sp., *Cyperus pangorei*, *Polygonum glabrum*, *Asclepias curassavica*, *Hygrophila auriculata* etc. were seen to be common here.

Typha angustata, *Jussiaea suffruticosa*, *Crinum defixum*, *Bacopa monnieri*, *Phyllanthus niruri*, *Ricinus communis* and *Ipomoea palmata* were the common plants seen growing around sewage overflows and effluents.

The most characteristic birds of this habitat are the long-legged herons and stilts. The numbers of egrets and Black-winged stilts have risen considerably in recent years on the rivers. Intermediate and Little



Map. 1. Habitats along the Mutha.

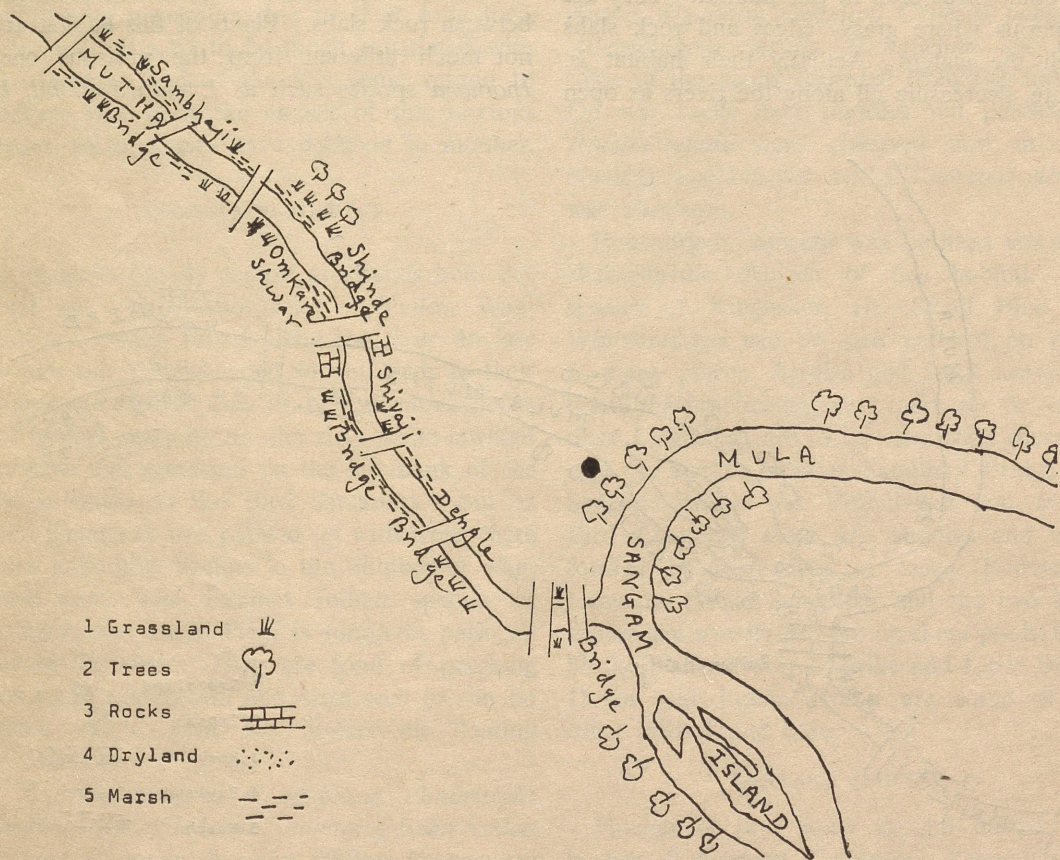
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egrets are more common than the cattle egrets which were mostly seen around sewage overflows and accompanying cattle. The egrets perch on rocks, islands and floating debris including the weed *Eichhornia* and were also seen to congregate around streams that pour a tremendous load of faecal contamination into the rivers.

Pond herons are more solitary than egrets. They feed at the edges of water and in dense masses of *Eichhornia*. By the beginning of April some cattle and little egrets came into breeding plumage. Large egrets, Grey and

Purple herons, and occasionally an open-billed stork and a White ibis were noted in this habitat, especially on the quieter stretches of the Mutha, i.e. between Dattawadi and the Pumping Station and in Bird Sanctuary. While the larger herons appeared to feed mainly on fish, egrets and pond herons were seen to catch insects from the vegetation at the edge and on islands. All the herons are only fair weather inhabitants of the rivers and disappear completely in June and July and reappear by August-end.

Blackwinged stilts are also a comparatively



Map. 2. Habitats along the Mutha and the Mula.

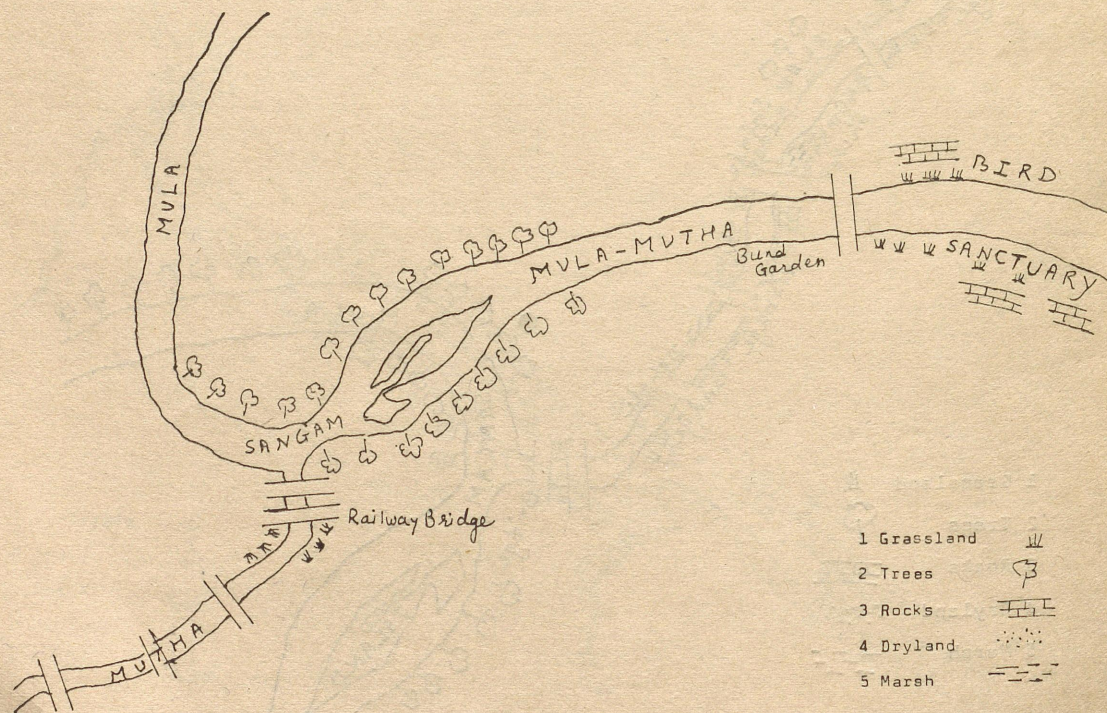
recent addition to the river fauna. They were detected in some numbers in 1968-69 and since then their number has been increasing year by year. Their flocks are to be invariably met with near sewage outflows and in and around streams that pour sewage in the river. They arrive by the end of September every year and their peak numbers are reached in January. In January 1983 over 2000 could be seen on the rivers.

Three species of Sandpiper, viz. Common, Green and Spotted, Little stint, Greenshank, Ruff and reeve, Little Ringed Plover etc. are the other birds seen in this habitat. They are numerous where grassy edges and rock slabs touch the waters. Actually their habitat is, of late, decreasing all along the rivers as open

water near the edges is being covered by *Eichhornia* especially in the Bird Sanctuary. Egrets, pond herons, wagtails and to a lesser extent sandpipers feed on mosquitoes, spiders and beetles hiding in its leaves. Yellow and White wagtails and to a lesser extent Large Pied Wagtail are thus found not only on the patches of turf and rock along the rivers but also on the floating water hyacinth.

MARSHY HABITAT

Water-logged areas are thinly spread along the rivers, especially where bays and inlets are formed and where there are depressions between rock slabs. Plants of this habitat are not much different from the previous one. *Ipomoea* species such as *I. carnea*, *I. nil*, *I.*



Map. 3. Habitats along the Mula-Mutha.

BIRDS OF A POLLUTED RIVER

muricata were recorded commonly in marshy areas. Also *Marselia*, *Rorippa indica*, *Homonia riparia* were recorded from marshy places.

The characteristic bird of this habitat was seen to be Snipe (Fantail or Pintail?) and to some extent Painted Snipes were usually found hidden in the short, wet grass. Where the grass is taller and typha stands abound, hide Purple and Indian moorhens. Bronzewing and Pheasant-tailed Jacanas used to be found on the river some years ago. The former has now completely vanished while the latter is seen in decreasing numbers year by year. Though these birds can take advantage of floating vegetation due to their long toes, they are not seen to be much associated with *Eichhornia*. Indeed there is some reason to believe that since the advent of this noxious weed, these species have declined in number.

GRASSLAND HABITAT

Wagtails usually exploit grasslands both dry and wet. Three subspecies of Yellow Wagtail are usually found along the river. In late winter the Yellowheaded wagtail adds to their numbers. There used to be enormous flocks of yellow wagtails on the dry, scrub-covered plateau and grassland on the left bank of the Mula-Mutha in the Bird Sanctuary. But as this plateau is now planted up with trees, there is a noticeable decline in the number of wagtails here. The resident Indian species of wagtail, the Large Pied, is found in pairs all along the river. They are fond of perching on rocks mid-stream and were seen to run on grass or to hunt for insects on floating *Eichhornia*.

Cyperus pangorei, *C. globosus*, *Fimbristylis bisumbellata*, *Eleocharis capitata*, *Echinochloa colona*, *Cynodon dactylon*, *Chloris barbata* are some of the typical plants of this habitat. can also be found along the Mutha river. On

ROCKY HABITAT

Rocks are exposed in several places along the Mutha. At Vitthalwadi there is a broad platform of basalt on the right bank. There is also a broad and high rocky platform on the left of the Mula-Mutha in the Bird Sanctuary. In between there are rock exposures on both the banks of the Mutha and rocky outcrops in the shallow river-bed. The deeper Mula does not show rocky exposures on either its banks within city limits or mid-stream.

Plants growing in rock crevices and between gaps in rocks were found to be mostly grasses. *Cynodon dactylon*, *Cyperus pangorei*, *Alternanthera sessilis*, *Commelina* sp. were some of the plants recorded from this habitat. On wet rocks near puddles red patches of *Rotella tenuis* were observed and in rock crevices and on wet rocks *Canscora diffusa* was also seen.

Redwattled Lapwing was perhaps the most characteristic denizen of this habitat. Two species of Kingfisher, viz. Small Blue and Whitebreasted can be seen perched on rocks at many places. As fish and frogs are to be found in practically every part of the rivers these kingfishers are to be seen everywhere except the stretch between Sambhaji Bridge and Sangam Bridge. At Vitthalwadi and in the Bird Sanctuary there are puddles and pools formed in depressions in rocks. Redwattled Lapwing, Green Sandpiper and the two kingfishers can usually be seen on these pools. Grey Shrike, Rufousbacked Shrike and Little Brown Doves and Indian Robin are some of the other birds found here.

DRYLAND HABITAT

Patches of dry, stony ground dotted with bushes of *Lantana*, *Calotropis*, *Pongamia* etc.

one such plateau in the Bird Sanctuary, trees such as *Erythrina* sp., *Bauhinia* sp., *Cassia* sp., *Bombax ceiba*, *Cochlospermum religiosum*, etc. are now planted.

Small bushes and stunted trees provide convenient perches for a number of bird species. Rufousbacked Shrike, Common Green Bee-eater, Stonechat, Black Drongo, Large Grey Babblers are normally seen to take advantage of these. Crows and Common Mynas are attracted to these dry, dusty patches on account of the movement of men and their cattle. The Common Myna has some favourite roosting trees along the river. Before flying into these trees at dusk the Mynas use these dry slopes as gathering stops where they assemble in enormous numbers moving into the roosting trees before sunset.

COMMUTING BIRDS AND BIRDS SEEN IN FLIGHT

The broad river channel of the Mutha appears to provide a route to commuting birds. In the morning Little Cormorants, Little and Cattle and Intermediate Egrets, Common Mynas and to a lesser extent Roseringed parakeets appear to follow the river on their foraging trips. They take the reverse route in the evening. Pied Kingfishers are fond of travelling a great deal along the river course. They favour the deepish pools, perching on wires running across the river or scanning the water surface by hovering in the air. They probably require a transparent surface and consequently were seen to be common at places where the turbidity index was low. In their beats up and down the river they rarely stop to hover between Sambhaji Bridge and Sangam. Gullbilled terns and Marsh Harriers patrol the river to and fro. The terns pick up insects and floating debris from the surface while the Harrier looks for larger prey. House Swifts, Eastern

Common and Redrumped Swallows and sometimes Little Pratincoles are seen to hawk insects in the air.

Trees lining the banks between Vitthalwadi and Dattawadi Bridge and again in the Bird Sanctuary area are seen to be patronised by such arboreal birds as Grey Hornbill, Golden Oriole, Koel, Crimsonbreasted Barbet, Iora, Grey Tit, Crow-Pheasant, Small Minivet etc. Even the call of the Grey Partridge could be heard from cultivation opposite the Pumping Station and near the Bird Sanctuary.

THE WINTER OF 1982-83

Between October 1982 and April 1983 systematic observation and counts of birds were carried out on the river Mutha and in the Bird Sanctuary on the Mula-Mutha. Birds were counted once every month while certain species were singled out for more intensive counts and observations. During this period 71 species of birds were recorded on the rivers. Their distribution according to habitat was:

- Deep-water Habitat: 6
- Shallow-water Habitat: 9
- Marshland Habitat: 16
- Dryland and Rocky Habitats: 24
- Riverside Trees: 5
- Birds in flight: 11

On any one day an average of 37 species were noted on the river Mutha during this period, with a total number of 1806 individuals. In this stretch of about 6.5 km this number gives an average density of 277 birds per kilometre. This number does not include arboreal birds seen on trees by the riverside. In the Bird Sanctuary on an average 1490 individuals belonging to 42 species were recorded on the days of counts. This 1.5 km stretch thus gives a density of 993 birds per kilometre.

As will be seen from Fig. 1 there are some

BIRDS OF A POLLUTED RIVER

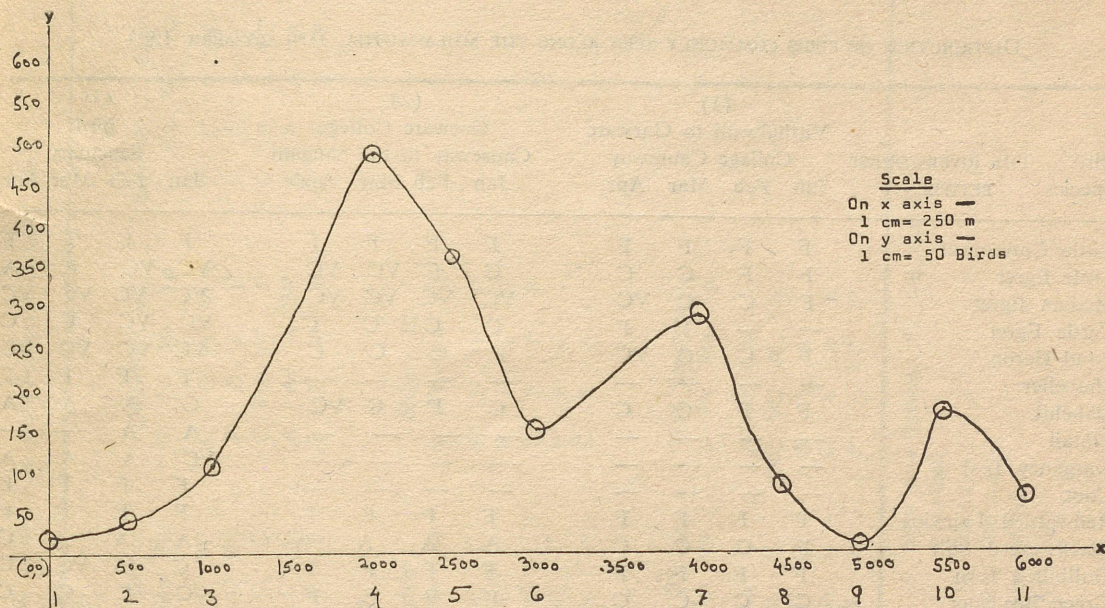


Fig. 1. Distribution of Birds along the river.

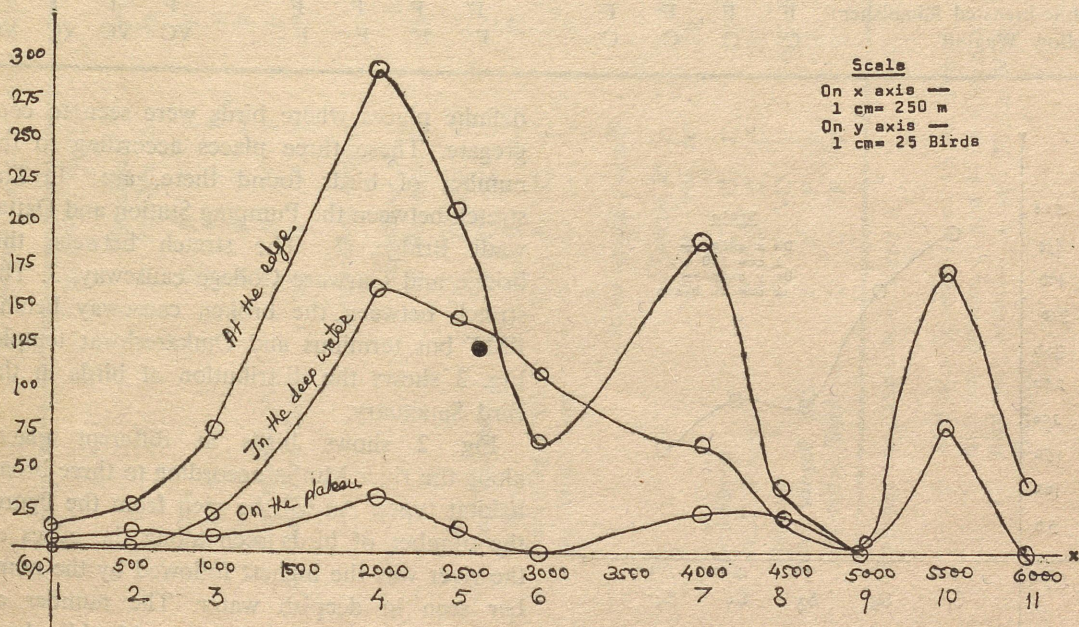


Fig. 2. Distribution of Birds along the river according to Habitat.

TABLE 2

DISTRIBUTION OF BIRDS COMMONLY SEEN ALONG THE MULA-MUTHA, JANUARY-APRIL 1983

Bird Species	THE RIVER-COURSE BETWEEN:-	(1) Vitthalwadi to Garware College Causeway				(2) Garware College Causeway to the Sangam				(3) Bird Sanctuary			
		Jan	Feb	Mar	Apr	Jan	Feb	Mar	Apr	Jan	Feb	Mar	Apr
		Little Cormorant	F	F	F	F	F	F	F	F	F	F	F
Little Egret	F	F	C	C	C	C	VC	VC	VC	VC	VC	A	A
Median Egret	F	C	C	VC	VC	VC	VC	VC	VC	VC	VC	VC	VC
Cattle Egret	—	—	F	F	C	C	C	C	VC	VC	C	C	C
Pond Heron	F	C	C	VC	F	C	C	C	VC	VC	VC	VC	VC
Shoveller	—	—	—	—	—	—	—	—	F	F	F	F	F
Dabchik	F	F	C	C	C	F	C	VC	C	A	A	A	A
Pintail	—	—	—	—	—	—	—	—	A	A	—	—	—
Garganey Teal	—	—	—	—	—	—	—	—	VC	A	A	A	A
Coot	—	—	—	—	—	—	—	—	F	F	F	F	F
Redwattled Lapwing	F	F	F	F	F	F	F	F	F	F	F	F	F
Blackwinged Stilt	F	C	C	C	A	A	A	A	A	A	A	A	C
Gullbilled Tern	F	F	F	F	F	F	F	F	C	A	VC	C	C
Green Bee-eater	C	C	C	C	F	F	F	F	C	C	C	C	C
Pied Kingfisher	F	F	F	F	F	F	F	F	F	F	F	F	F
Small Blue Kingfisher	F	F	F	F	F	F	F	F	F	F	F	F	F
White-breasted Kingfisher	F	F	F	F	F	F	F	F	F	F	F	F	F
Yellow Wagtail	C	C	C	C	F	F	F	F	VC	VC	VC	VC	VC

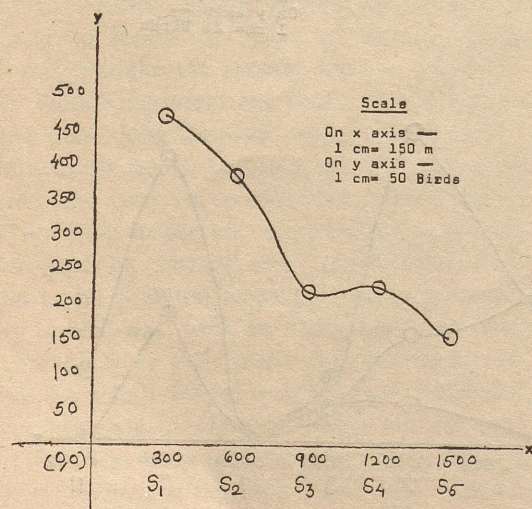


Fig. 3. Distribution of Birds in the Bird Sanctuary.

definite places where birds were seen to congregate. These three places according to the number of birds found there, are: 1. The stretch between the Pumping Station and Dattawadi Bridge, 2. The stretch between this bridge and Garware College causeway, 3. The stretch between the broken causeway behind PMT bus terminus and Omkareshwar temple. Fig. 3 shows the distribution of birds in the Bird Sanctuary.

Fig. 2 shows birds at different places along the river Mutha according to three broad habitat types. As will be seen from the figure, the number of birds seen along the edges of the river was the highest followed by the number seen in deepish water. The number of species seen along the edges was 15 while those

seen in deepish water was 7. Some of the species like Blackwinged Stilt were common to both these habitats. In the Bird Sanctuary (Fig. 4) the number of species seen along the

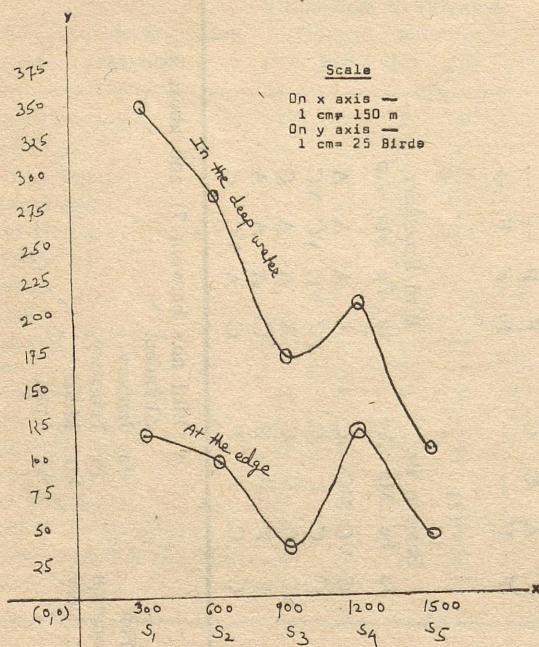


Fig. 4. Distribution of Birds in the Bird Sanctuary according to Habitat.

edges was 17 while in deepish water the number was 12. While counting these numbers such species as House and Jungle Crow, Common Myna, Pariah Kite and Little Brown Dove which are not strictly river-birds are excluded. In the bird count taken in March 1979, in the Bird Sanctuary, 39 species had been recorded with a total number of about 1200 individuals (P. Gole 1980).

The quality of water where birds were seen to concentrate, was also examined. As has been pointed out in the section on water-quality, the river takes on an increasing load of organic pollution as it flows from Vitthalwadi on-

wards. It will now be interesting to see if any change in the composition of bird species in different months on the stretches where birds concentrated, can be detected. Table No. 2 gives this information. The table shows that in the first two stretches the numbers of egrets, stilts, dabchiks, and Gullbilled terns are low; while these birds become more numerous from Garware College causeway to Omkareshwar temple. We have recorded in greater detail the distribution of these species between January and April. Table No. 3 shows their distribution along the entire river course. From this it is clear that these birds are fewer where the quality of water is better and drains do not overflow into the river. Their numbers progressively increase as the quality of water deteriorates and its organic content goes up. It appears that these birds have adopted the role of scavengers along the river course. Special mention should be made of Blackwinged Stilt. These were found to be concentrated, at places in very large numbers, where streams loaded with faecal matter and drains flow into the river. To a lesser extent this can be said to be true of the three species of egrets also. Gullbilled terns were also seen to patronize such places in numbers and to swoop repeatedly to pick up floating organisms.

As the summer advances and April gives way to May, most of the migratory birds including the hordes of Blackwinged Stilt which make the dirty river so colourful, will have left. June and July would see even the egrets disappearing from the river. With the monsoon in full swing, floods roar down the river channel and the turbulent stream appears to cleanse itself of all the dirt that man continues to heap on it.

ACKNOWLEDGEMENTS

The study formed a part of the much wider

BIRDS OF A POLLUTED RIVER

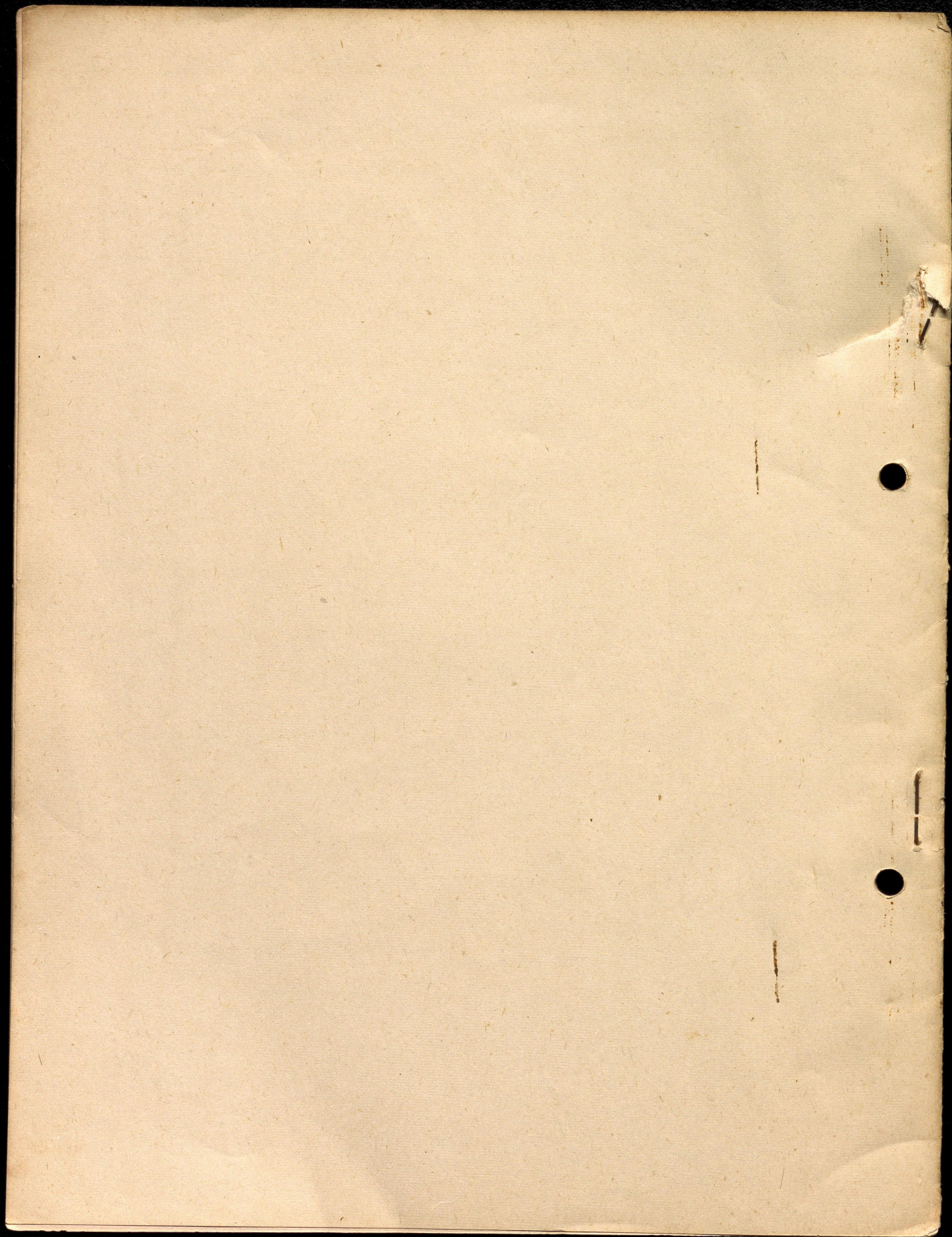
investigation aimed at drafting an eco-development plan for the improvement of Pune's river-fronts. This wider study was financed by the Ecological Society of Pune. I was helped in the field by Miss S. Limaye, Miss S. Ranjekar and Miss S. Jangam. The water-samples

were analysed by Shri Kirad of Kirloskar Consultants Ltd. and Dr. Godbole of Vidnyanvardhini. Botanical specimens were identified by Dr Vartak of Vidnyan-wardhini and Miss Sane of Garware College. I thank all these persons.

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Bird-Watching in Myanmar (Burma)

Myanmar, our neighbour to the east, is almost a closed book as far as birds & ornithology are concerned. During the British period Burma was a part of the Indian empire & many Indians had either settled there or were there for business and employment. Burma closed its doors after it gained independence in 1950 & many Indians (& Chinese) either left the country on their own or were thrown out. Very few foreigners could gain access to the country since those times & among them bird-watchers & ornithologists were fewer still.

B.E. Smythies' *Birds of Burma*, first-published during W.W.II in 1940 & again (2nd edition) in 1953 remains the only book that gives a comprehensive account of that country's bird life. In recent years some information has begun to trickle down as Myanmar is slowly opening its doors to foreign visitors. Recently ^{published} C. Robson's *A Field Guide to Birds of Southeast Asia* gives ^{some} ~~contains~~ ^{useful} information on Myanmar's birds (though for some birds we found it to be not very accurate).

For its size Myanmar has one of the richest avifaunas. Smythies gives an estimate of almost 1000 species. Birds that belong to Indomalayan, Indochinese & Malayan sub-regions of the Oriental realm constitute the avifauna. In addition, Palearctic species including

resident ones of Sino-Himalayan & migratory ones that breed further north, are also found in Myanmar.

The habitat composition of the country is probably responsible for the richness of the avifauna. Even today almost 50% of the country is forested. Forest types vary from evergreen to dry zone scrub & hill savanna. There are very few roads in Myanmar. We travelled for 10 hrs. on one of their major roads which was probably no better or even worse than the unmetalled tracks in our sanctuaries & national parks. Absence of roads, tracks & settlements in the interior areas in mountains makes many forest areas inaccessible. It is here probably the most of Myanmar's wildlife including birds, lizards, and Myanmar is a country of mountains, hills, deep, narrow valleys, broad flood plains & plateau uplands. In the north are the mountains of the Himalayan chain arching to south-east. The north-south ridges are scoured by the Chindwin & the Irrawaddy two major rivers & their tributaries. Further east are the Shan uplands & the flood plain of the Salween. The southern part constitutes the deltaic regions of these rivers and coastal areas with mudflats & mangroves. In the middle is the rainshadow area - is

My friend from the Netherlands who had organized this trip was hopeful of locating the Pink-headed Duck in Burma. He had studied maps & charts used by pilots & had selected areas which were likely to have habitat suitable for this species. We had permission to visit northern areas. Therefore, the dry zone of the country, Arakan, the region adjacent to Bangla Desh and Tenasserim, the coastal region to the south have their characteristic landscapes, vegetation & hence bird life.

Only a few areas are open to foreigners. On the whole, they are not allowed to use roads but must restrict themselves to rail or air. From Yangon (formerly Rangoon) we had to fly to north to Myittha (pronounced Michina) & were allowed to use roads & waterways (rivers) north & south of this capital city of the north. My observations are therefore, spatially quite restricted - Yangon & the northern areas!

In my stay of about 3 weeks in these areas, I could record 160 species. We could only examine fringes of evergreen forests. In these fringes we could observe the Great Pied & Blunt-billed hornbills, the Imperial pigeon, 2 species of bulbuls - the Olive & the Blyth's & 2 " " Cuckoo - Blue-eared & Linnet-like. The Green-billed Malkoha was seen in a landscape of groves of trees interspersed with cultivation. Red jungle fowls crossed our paths ^{again} against forests opened up by cutting, shifting cultivation, roads & tracks & hamlets. Green-billed woodhoopoes & were home to scarlet minivet, greater whistler, Gold-fronted chlorophanes, Blue-throated barbet, Tree pie, Emerald dove & Golden-backed woodpecker. Birds of prey such

eagle

no coasted hawk, changeable hawk eagle & black eagle were seen in flight circling over such areas.

We had been especially looking for forested wetlands but could not locate many. Typically they were found to be the nesting & roosting habitat of ducks mainly spotted-billed duck & cotton teal.

Hamlets & small villages carved out of forests together with their fields constituted a distinct habitat. ~~The~~ Scattered trees, trees standing around houses & along nearby streams together with open fields described this scene. King crow, grey-headed, jungle and collared mynas in small flocks & parties, Red-breasted parakeets in small flocks, spotted & Rufous turtle doves in ones or twos, a few occasional pied & Red-eared bay woodpecker, black-headed oriole & lesser coucal added colour to the landscape; while trees by the side of cultivation were inhabited by Indian roller, red-whiskered bulbul, tailor bird, tree pie, chestnut-headed bee-eater, black bulbul & weaver birds. Tiny Phylloscopus warblers searched flicked through branches challenging the observer to identify them correctly.

A little outside villages the roadside hedges harboured Pied bush chats, Black-headed ^{& Rufous-backed} shrikes, magpie robins, Stonechats, pied flycatchers

& hoopoes. Vegetable fields & grain cultivation had large-size striated warblers, wren warblers, orangebilled mynas, redvented bulbuls & Kestrels & King crows perching on overhead cables. Large flocks of R.T. Dove found.

Myithyina sits at the head of a broad, extensive ^{plateau} where the majestic Brawaddy comes out of the hills & forms its broad, fertile alluvial plain. The mighty ^{river} with its clear waters, ^{shiny} golden shingle beaches, mudflats & alluvial islands looks extremely impressive & is home to innumerable ducks, geese & Waders. Brahminy ducks outnumber all others such as pintail, garganey, gadwall & mallards. Faggles of Barheaded & greylag geese (few) could be seen resting on riverine islands. Tall alluvial ridges along the river had colonies of sand martins, a few rocky ones showed plumbeous redstarts & blue rock thrush while trees along the banks concealed chestnut bellied thrushes & noisy swallow shrikes, stockbilled kingfishers

On the shingle beaches were seen spursized plovers, a variety of gulls including brownheaded, herring (most probably Henglin's) & common (Plew gulls). On mudflats flocks of little pratincoles were seen to merge beautifully with their ^{surroundings} white sand beaches, little egrets & grey herons looked intently for morsels of food. 2

lesser adjacent stocks & blackstocks ^{small} flocks were also there.

In the river & on islands fished & rested
dozens of little & large cormorants while river
terns & ospreys ^{circled} hunted flew overhead.

Formigano ducks & geese, spotbills & red-
breasted mergansers swam in the shallows.
In Deeper waters ^{could be found} a variety of grebes,
— great crested, black-necked & slawson.

All in all the variety & no. of these
birds ^{was} indeed impressive & reflected
the bounteous & unpolluted character of the
habitat.

South of Myitkyina lies an extensive
flat plain devoted entirely to paddy &
other crops. In winter most of the fields lay
fallow & what a delight they provided us!
In early morning the horizon resounded with
clarion calls of common cranes as flock after
flock ^{materialised} as if from nowhere. A
descended in liver fields to feed. Robson
mentions this crane to be an uncommon
winter visitor to N Myanmar. Our estimate
is that 3000 - 5000 Common cranes must
be wintering in this area. It was not
known till now that such a good population
wintered in this area. Write my friend,
ornithologist J. van der Peijl.

Wet fields were found to be occupied
by substantial gatherings of bar-headed
geese & ruddy shelducks. It was known
that this pair wintered in Burma especially

on the Chindwin & the Irrawaddy. But no estimate was forthcoming. We estimated that 4000 to 5000 geese must be wintering in this part along the rivers. The total no. of muddy shelducks seen must be close to 10,000.

Other birds of fallow fields & open areas included white-headed myna, green bee-eater, pied myna, golden plover, paddyfield pipit & cattle egret. Black kite, pale harrier, Jungle Crow were the typical birds of prey & carrion-eaters of this area.

With plentiful rainfall and free-flowing rivers, one expects Myanmar to be well endowed with wetlands. This indeed is the case especially in the flood plains of rivers & their delta regions. But we found that wetlands were under great pressure of fishing, hunting, trapping and agriculture. Typical wetland birds such as egrets & herons, kingfishers & waders, sandpipers & sand plovers, moorhens & jacanas, whistling & cotton teals were rare but nowhere common or in good numbers.

The only bird of unusual interest that we saw was a whitebellied heron.

Better numbers of birds were observed in wetlands that were protected from over exploitation, such as the lakes within the city of Yangon. Darters were observed only on these lakes.

Marsh
& Pied
harriers

Indeed Yangon with its beautiful parks
& well-kept gardens, with its traditional,
low profile architecture & variety of modern
skyscrapers, with its cleanliness, absence of
shams & disciplined traffic ^{is} was a delightful
city. It reminded me of Bombay in the
sixties. The familiar house crow, common
myna & rock pigeons of Indian cities were
there too but there were probably more
tree sparrows & than house sparrows & colonies
of blue-tailed bee-eaters, edible nest swiftlets
& egrets & herons right in the middle of
the capital. This green city nestling under
the sublime, golden sheen of the
Shwe Dagon Pagoda makes a lasting
impression ^{on your mind} as you leave the country.

Migration

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Migration is common to human & non-human societies or communities. Insects, birds, fish, animals migrate from one region to another for various seasons. Most non-human migration is north-south in direction. The most spectacular migration known is bird migration. Birds migrate over vast distances taking in their stride world's highest mountains & limitless oceans. In India over 300 species of birds are known to migrate mostly in north-south direction. They spend ~~winter~~ fall & winter months, i.e. from October to March in India & fly north towards Siberian wilderness in spring & summer. North Siberia is a vast marsh where once snow-covered thaws food is plentiful, both plant & insects. They take advantage of this plentiful food to rear their young ones & set sail south ~~at~~ the end of August or beginning of September. Some of our migrants go to Himalayas where they nest in high altitude forests & Alpine meadows & in crags in the steep precipices of the great mountain. Here again food is plentiful in summer.

Back in winter they occupy specific habitats where food, shelter & security are available. Many settle along the banks & sands of our great rivers - ~~to~~ the Ganga, Yamuna, Brahmaputra, Godavari, Krishna & Kaveri. Some find forage & shelter in mangroves & on sea shores. Large lakes & wetlands & marshy areas like the Sunderbans also harbor a variety of migrants. Some like outskirts of human settlements while others move into large public & private gardens & some even congregate in lakes smack in the centre of an urban area. Witness the lake in Jamnagar city.

Some human communities are known to protect birds & animals like the Bishnois of Rajasthan. In Kichan, again in Rajasthan, people feed migratory cranes who assemble in great numbers in a particular open area in the town where they are offered food. The Monpas, a Buddhist community from Arunachal Pradesh & the Ladakhis from Ladakh also protect birds, especially the

rare Black-necked Crane & Bar-headed Goose
— the Rajhansa.

On the other hand Migration route may pose great danger to birds. Formerly in Europe, especially in Spain, Italy & Greece thousands of birds were killed when they migrated in flocks. The most numerous bird in the world, the Passenger Pigeon of USA was thoroughly massacred by Americans till it became extinct. The last Pigeon died in 1917. Birds entering India from the north-west, i.e. Afghanistan & Pakistan also fall a prey to guns. To avoid certain death many birds migrate during the night. The other calamities that they face during migration include dense fog, blizzards & hurricanes, heavy snow fall etc. The fog disorients them & they may land in unexpected places. Storms blow them hither & thither & many die for want of food & shelter. Migration is the greatest adventure in the life of birds & they take up this challenge every year without fail though there are recalcitrant individuals which may fail to migrate

संत तुकारामांच्या 400 व्या जयंतीच्या निमित्ताने पुण्यातील आम्ही काही लोक "संत तुकाराम व्यासपीठाची" स्थापना करित आहोत . त्याचे अध्यक्ष सुप्रसिद्ध साहित्यिक, तत्वज्ञ आणि तुकारामांचे वंशज प्रा सदानंद मोरे असतील . वृक्षवल्ली आम्हा सोयरे वनचरे हे या व्यासपीठाचे घोषवाक्य असेल . तुकारामांचे अभंग जीवनाच्या विविध अंगांना स्पर्श करतात . विविध कार्यक्रमांद्वारे तुकारामांचे संदेश महाराष्ट्राच्या कानाकोप-यात पोचविण्याचे काम हे व्यासपीठ करित राहिल . या कार्यक्रमांचा रोख असेल गरीब आणि वंचित लोकांची उन्नती साधणे . या उन्नतीस पोषक असे पर्यावरण, अर्थकारण आणि मूल्यधारण (Environment, Economics & Ethics) साध्य करण्यावर या कार्यक्रमांचा भर असेल . व्याख्याने, चित्रफिती, नाटय, नृत्य, संगीत आणि निर्सगात प्रत्यक्ष काम करण्यासाठी शिविरे असे कार्यक्रमांचे स्वरूप असेल . स्थानिक कार्यकर्ते, बुद्धिमंत, कलाकार आणि ग्रामस्थ मंडळी यांच्या सहकार्याने हे कार्यक्रम पार पाडले जातील .

महाराष्ट्राच्या निरनिराळ्या शहरात व गावात या व्यासपीठाच्या शाखा उभ्या करण्याचा प्रयत्न सध्या सुरू आहे . या शाखा मध्यवर्ती व्यासपीठाच्या सहकार्याने कार्यक्रमांची आखणी करून ते पार पाडतील . व्यासपीठाच्या उद्घाटनाचे संयोजनही सध्या सुरू आहे . त्याचे स्थळ, दिनांक आणि वेळ लवकरच जाहीर करण्यात येतील . या कार्यक्रमास सर्वांना अगत्याचे आमंत्रण आहे .

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e-mail: prakashgole@yahoo.com

in a particular year.

How birds determine the direction of migration, how do they find migration route ~~is~~ still remains a mystery. Scientists have carried out number of experiments to find the truth. It is possible that during day & night the position of the Sun & the Moon & even particular stars may give birds a clue of direction. They may be taking into account the lie of the land or the way, physical features like rivers, lakes, hills & valleys, the sea shore. But the strangest thing is in the fall migration when they are heading south from their northern breeding grounds, it is the newly hatched young ones who lead the flock & show them the direction to fly. It looks as if the sense of direction is ingrained in them. Such mysteries make bird migration all the more attractive.

So next time you go out try to meet a migrant bird or he/she may in your backyard garden, in old growth trees in cities, on the river or in open spaces girdling our cities. Befriend them.

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२००९ - २०१० या शैक्षणिक वर्षातील अभ्यासक्रम

१. संपूर्ण वर्षाचा, पदव्युत्तर डिप्लोमा अभ्यासक्रम , सुरुवात १५ जुलै २००९ पासून निसर्गाची सर्वांगीण ओळख, निसर्ग व माणूस यांच्या संबंधाची तपशीलवार छाननी, आजच्या पर्यावरण समस्या आणि उपाय . भरपूर प्रॅक्टिकल्स, निरनिराळ्या परिसंस्थांमधील ४ शिबिरे . शुल्कः रू . १२,०००/- संपूर्ण वर्षासाठी (शिबिर शुल्क वेगळे)
२. निसर्ग परिचयः ३ महिन्यांचा छोटा अभ्यासक्रम . सर्वासाठी खुला . खास शिबिरांमधून नैसर्गिक परिसंस्थाशी जवळीक आणि त्यांच्या व्यवस्थापनाची ओळख . सुरुवातः १५ ऑक्टोबर २००९ पासून, शुल्कः रू . ३०००/- (शिबिर शुल्क वेगळे)
३. भटकबहादरः शालेय विद्यार्थ्यांसाठी सुट्ट्यांमध्ये खास भटकंती . पर्यावरणाची आणि निसर्गाच्या पुनरुज्जीवनाची ओळख आणि प्रत्यक्ष कार्यानुभव दिनांक आणि शुल्क वेळोवेळी जाहिर करण्यात येतील .
४. कार्यशाळा : अभियंते, आर्किटेक्ट्स, औद्योगिक आणि कृषी क्षेत्रात काम करणारे, निरनिराळ्या विभागातील सरकारी अधिकारी व कर्मचारी, पर्यावरण शिक्षक आणि कार्यकर्ते यांच्यासाठी, मागणीप्रमाणे १ ते ७ दिवसांच्या कार्यशाळा घेतल्या जातील .

यासाठी संस्थेच्या कार्यालयात चौकशी करावी .

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दूरध्वनी: ०२० २५६७७३१२ ई मेलः ecological.society@gmail.com