Birds are supposed to be the indicators of the ~~qual~~ environmental quality. Was it true as far as the conditions of on our west coast go?

In our ornithological survey the most numerous birds that we found on ~~our~~ Konkan's sandy beaches were gulls: Brownheaded & Blackheaded. These gulls are migratory. They breed either ~~on~~ around the high altitude lakes of Ladakh & Tibet or on the beaches of Europe. At one time an arm of the sea extended right upto the region which we today call the Tibetan plateau. The descendants of the gulls who bred on the beaches surrounding the Tethys sea still migrate to their ancient breeding grounds though the sea has long disappeared. They now breed on islands in Saline & freshwater lakes of Ladakh & Tibet. But what is of importance for us is the fact that the gull is essentially a scavenger. It frequents garbage dumps in Europe or in and around the sea coast picks up scraps of food (dead fish & other sea creatures) thrown overboard by the fishing vessels. There is no dearth of these vessels on the coast today. One can see scores of them fishing or trawling in the shallow seas adjoining the coast. Their big nets scour the sea bed & scoop up everything including many creatures that are not in demand in the market. They are just thrown back into the ~~beach~~ sea either dead or severely mauled – a predigested meal for the scavenging gulls. The sight of huge flocks of gulls squealing & dancing in the air as the trawlers come ashore is really stunning. At other times these birds pick up scraps of garbage & other waste material just lying on our beaches, or floating down the estuaries. With industrialization & rise in shanty settlements the no. of scavenging gulls must have increased too. In this sense these birds are indeed the indicators of the quality of the environment.

The other bird that ~~I~~ we would like to mention here is the Blackcapped Kingfisher a cousin of the familiar White-breasted Kingfisher that we see everywhere – near water as well as around fields & gardens. The Blackcapped one is a denizen of mangroves. While the number of gulls on our coast has increased, the Kingfisher has become extremely rare. We had to search hard to find them and over the entire stretch of about 500 Km of the coast we found just half a dozen of them! This shows that the Kingfisher's habitat, i.e. mangrove swamps has declined both in extent & quality. Mangroves are under heavy exploitation for their fuel & timber value. No substantial mangrove patches now remain on the west coast. The coast is being exposed ~~*~~ more & more to the erosive influences of the wind & waves. Their impor-tance as breeding grounds for marine fish & other creatures has declined as well. Not only do they not offer any shelter & security for the breeding fish, the tempe-rature regime of their waters has changed too. This was brought to our notice by the traditional fishermen who depend on their livelihood on fish who breed in mangrove swamps. They cannot fish in deep seas in their small vessels. In estuaries, according to them, not only the quantity of fresh water flowing down from the uplands is reduced, but the water that flows in shows marked temperature ups & downs that kill the fish spawn. Barrages built for irrigation on the streams & industries releasing effluents are both responsible for these conditions. Both have affected the local fishermen ~~who~~ adversely. Moreover they have to face stiff compe-tition from trawler owners, who even de-mand that they should be allowed to fish during the monsoon season — the breeding season of fish, when no tradi-tional fisherman goes out to the sea.

But there is one bird that so far seems to remain~~s~~ unaffected by industrialization & urbanization. This is because its breeding habitat ~~is not~~ remains largely unaffected.

This is the Whitebellied Sea Eagle, a stately-looking magnificent avian that patrols the sea coast like a guardian of all things natural! The eagle builds its large nest on tall casurina trees. Casurina groves that provide an imposing backdrop to many a beach were planted by the Forest Dept. to protect the ~~land~~ coast from sea erosion & to provide firewood & low quality timber to the people. Landowners have also planted these trees in their backyards many of which are utilized by the eagle for nesting & perching. If these groves are removed to make way for beach resorts, & hotels and their likes the eagle's breeding sites will be gone leading to the decline of another impressive bird their disappearance in future

All this does not seem to be farfetched. The offshoot of industrialization and urbanization is commercial tourism. Politicians are openly dreaming of converting Konkan's beaches into tourist hot-spots. Only a week ago newspapers carried a story of forcible acquisition of poor peoples' (fishermen's) land near the sea for a five-star hotel.

In a sense this looks inevitable. With large-scale investments, the old order of small-scale cultivators, orchard owners & those who depended on money orders from their Kith & Kin working in the metropolis, will be replaced by one consisting of the industrial & trading elite, a middle-level of technocrats & white-collar executives & a lower one of blue collar ~~workers~~ & technicians & machine operators. The land, its characteristic produce, the bio-diversity its climate, soil & plant life are able to give rise to, will hardly matter in a value-added economy dependent on imports. The question then ~~I~~ we want to pose is for whom do we intend to manage our coast-line?

Is it for the small fisherman, for the poor cultivator or the small orchard-owner? i.e. all those who are likely to disappear in the near future. Or is it for the new industrial & commercial order that is fastening its grip on the land?

Social justice demands that the state should intervene on behalf of the poor. It should assist the poor to better their lot. But the state today appears to be under the mistaken belief that only by depriving people of their land & their way of life & converting them into wage labourers that their standard of living will be upgraded. Political leaders appear to steadfastly believe that poverty can only be wiped out by large scale industrialization, urbanisation & commercial agriculture, & not by enhancing the quality & productivity of the soil, the water, or by enriching bio-diversity. ~~In this situation~~

If this belief continues coastal management will increasingly be in the interests of the new elite - commercial tourism, intensive mechanised fishing, high input bio-technological fish & sea creature (e.g. prawns) breeding & the like. The experience of industrial countries shows however, that these activities lead to heavy pollution, degradation of biological life and accentuated social inequalities. Affluence breeds squalor!

But this cannot be the only way to manage our coast. There is an alternative and a benign one at that, though it cannot promise fabulous wealth & (consequent high inequalities) high profile consumerism. It is based on rejuvenation of the soil, invigoration of indigenous flora and fauna & restoration of the landscape — be it escarpments, hill slopes, river & stream basins, mangrove swamps, mud flats & the beaches. It will provide for not the greed of the few but the needs of everybody.

The techniques of restoration of nature are fast becoming sophisticated & immaculate in the industrialized countries who had experienced the ill-effects of ~~high grade~~ intensive industrialization & commercialization. Societies who still remain enamoured of high profile consumerism which these two bring about, can hardly be expected to look seriously into the possibilities of restoration of nature. ~~The~~ Today's political &

Social will frankly points to a coastal management that benefits the rich.

BIRDWATCHING IN KYRGYZYSTAN

The plane touched land and I came out. Not far from the plane I saw a flock of Common myna. I was surprised. For it was not any Indian airport that I had landed. It was Tashkand airport! So the ubiquitous myna must have crossed the Himalaya no one knows how and when. But here it was in Central Asia as nonchalant and matter-of-fact as in its Indian home.

Soon I boarded another plane to go to Alma-Ata(Almaty for short) the then capital of Kazakstan where I was picked up by friends and motored to Bishkek(formerly called Frunze) the capital city of Kyrgyzystan. There I was to accompany an expedition to some high altitude wetlands to observe nesting birds: waders, ducks and geese, Barheaded geese in particular.

I reached Bishkek in the dead of night at 2 a.m. It was bright sun the next morning when I woke up. On the eastern horizon I saw the mighty Tien Shan rising to a height of 4 to 5 thousand metres(12 to 16 thousand feet), their snow-clad peaks luminous and clean against a background of clear, blue sky. Bishkek sits in a broad valley drained by several streams which cascade down from the snows of Tien Shan. The willows and poplars, the lush green fields of wheat, barley and alfa alfa reminded me of the vale of Kashmir. Spring had begun, ice and snow had disappeared and birds have appeared followed by the inevitable bird-watcher! We spent the next two days looking at birds around Bishkek, in the countryside, in hills and on wetlands.

Bishkek is well-planned with broad streets flanked by quiet sidewalks lined with trees. Blackbirds(Turdus merula) flitted among trees with Turtle doves(Streptopelia turtur) dropped down to pick up grains and grit. On the lawns Hoopoes(Upupa epops) probed the ground with their long beaks while the Eurasian cuckoo´s (Cuculus canorus) rhythmic call was often heard.

On the outskirts perched on telephone cables were European bee-eaters(Merops apiaster), Eurasian rollers(Coracias garrulus) and an occasional Mistle thrush(Turdus viscivorous). Flocks of Rose-coloured starlings(Sturnus roseus) whizzed past looking for nooks and crannies around villages where they would nest. Large Eurasian swifts(Apus apus) appeared suddenly sailing effortlessly on their bowed wings out of sight the next moment.

The foothills of Tien Shan are rounded and smooth, gently sloping and carpeted with verdure. Several birds greeted us as we motored up and down the gentle slopes. Cinnamon sparrows(Passer rutilans), Eurasian Goldfinch(Carduelis carduelis) and Greenfinch(Chloris chloris), Rock bunting(Emberiza cia) and Redheaded bunting(Emberiza bruniceps), Pied flycatchers(Muscicapa hypoleuca), Common rosefinch(Carpodacus erythrinus) in bushes and Kestrel(Falco tinnunculus) and Common buzzard(Buteo buteo) on poles and cables.

There are several natural and man-made wetlands around Bishkek with good aquatic vegetation: Hydrilla, Potamogeton and Cyperus and bordered with Phragmites. Common terns(Sterna hirundo) quartered the space above open water, Large cormorants(Phalacrocorax carbo) fished and Garganey(Anas querquedula), Ferruginous duck(Aythya nyroca) and Tufted duck (Aythya fuligula) rested in deeper water. Near the banks were Grey herons(Ardea cinerea), Blackwinged stilts(Himantopus himantopus) and Common gallinules(Gallinula chloropus). In the Phragmites lurked Little bitterns(Ixobrychus minutus). Overhead, on slopes around wetlands soared European pratincoles(Glareola pratincola) and Black kites(Milvus migrans).

The high-altitude lakes that we wanted to visit were Song Kul at over 3000 metres and Issyk Kul situated at about 2000m. altitude. The former which remains frozen for 9 months of the year, is 50 km long and 10 km wide. It was known to be a favourite nesting place for a variety of waterfowl. To reach it we crossed the Tien Shan range south of Bishkek and went up a steep, zigzag path through pine and birch to arrive at a seemingly limitless, open alpine pasture at an altitude of 3100 metres. Mountains 4000 to 4500 metres high ranged on all sides to cover the distant horizons. The land sloped gently towards the centre where a broad, gleaming sheet of fresh water formed the lake. On the way up we found a nesting pair of Lesser kestrel(Falco naumanni), saw several Black-billed magpies(Pica pica), Hill pigeons(Columba rupestris), Red-billed choughs(Pyrrhocorax pyrrhocorax) and Ruddy shelducks(Tadorna ferruginea) on mountain tarns.

We had to pitch tents in the open as no cover of either vegetation or topographical features was available. Here for a week we were buffeted by icy winds and blizzards, rain, hail and storms. Yet it was a life-time's experience to come to see how birds live and nest in this difficult, windswept landscape.

I was reminded of Ladakh as I saw the familiar Ranunculus and Potentilla, Astragalus and Caragana around our camp. In the little puddles and ponds around the lake grew familiar aquatic vegetation such as Potamogeton and Myriophyllum, Limnophylum and Marselia. There were several holes around our tents which were occupied by Marmots and Voles who would come out early morning and at dusk when their enemies--eagles, buzzards and foxes were not around. In the noon when everything was quiet on the camp, a marmot would often pop out of his hole to look inquisitively at our tents and equipment. Horned(Eremophyla alpestris) and Calandra larks(Melanocorypha calandra) were around too.

The nesting birds occupied small islands and floating rafts of vegetation on the lake. The colonially-nesting Blackheaded gull(Larus ridibundus) outnumbered others. In the second week of June many had chicks which scampered and hid among sedges as we approached these islands in inflatable rubber boats. There were nests of Great crested grebes(Podiceps cristatus) and Common terns, while only 10 nests of Barheaded geese(Anser indicus) could be found. The nests were shallow hollows on the ground lined with grass. The clutch varied from 2 to 7 eggs, 4 being the more common number. A Greylag (Anser anser) pair was also seen nesting. There were several Barheads around whose number easily came to 60 but only a few appeared to be successful in nesting. Shortage of safe nesting places like islands seemed to be the main reason why so many Barheads could not nest.

Nests of Blacktailed godwit(Limosa limosa), Blacknecked grebes(Podiceps nigricollis) were scattered on islands and concealed in vegetation around puddles on the shore. Snipes and Redshanks(Tringa totanus) also nested in ground vegetation. Tufted and Ferruginous ducks, Gadwalls(Anas strepera) and Red crested pochards(Netta rufina) nests with as many as 10 to 20 eggs were well concealed in steeply sloping banks of the lake.

In our forays in the big, open grasslands we once came upon a pair of Demoiselle crane(Anthropoides virgo), Mute swans(Cygnus olor) in far corners of the lake, a pair of Black storks(Ciconia nigra), a Lammergeier(Gypaetus barbatus) and to the western end of the lake many Ruddy shelducks and Lesser and Greater sandplovers(Charadrius mongolus and leschenaultii). Often a Raven(Corvus corax) flew by and often we disturbed Merlins(Falco columbarius) perched on little mounds in the grass.

Lake Issyk Kul at a lower altitude, is almost an inland sea. It is 170 km long, 60 km wide and 700 metres deep. Earth movements caused this great depression which was later filled with water from the streams flowing from the surrounding mountains. 44 streams large and small, feed it. The water retains its fresh character though the lake appears land-locked. Settlements surround Issyk Kul though the population is small. Many parts of its banks are protected reserves. We found the birds concentrated at its eastern end which is almost a flat grassland with bays and inlets and small islands near the banks. There were more than 200 Mute swans and over a 1000 Ruddy shelducks. Shovellers (Anas clypeata), Wigeons(Anas penelope), Mallards(Anas platyrhynchos) and numerous waders could be seen also. A small flock of Demoiselle crane was resting on the bank. Big crane flocks stage here in the fall season on their southward migration, we were told. I was surprised to find that this part of the lake so rich in birds, was not included in any reserve.

As we left Issyk Kul and neared Bishkek a flock of Common myna raced our vehicles. They perhaps came to remind me that I must soon return home.

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SOME MANAGEMENT CONSIDERATIONS FOR BIRD SANCTUARIES

The Need for Management:

Of late a spate of demands for creation of bird sanctuaries has surfaced from groups and associations of bird-watchers. In Maharashtra the movement gathered momentum after the inauguration of Mula-Mutha Bird Reserve by Dr. Sálim Ali in 1977. The All-Maharashtra Bird-watchers' Meet which is an annual event, has recommended creation of bird sanctuaries at Mayani, about 70 km.s north of Sangli, at Jayakwadi, about 50 km.s south of Aurangabad and at Nandur-Madhmeshwar 60 km.s east of Nasik. These three proposals have been accepted in principle by the government and areas around all these three wetlands (irrigation reservoirs and their environs) have been declared as protected areas.

Once the decision to 'develop' a particular area as a Sanctuary is taken, the Forest Department goes ahead with planting trees in the area. For example, the foreshore area of the Mayani reservoir, the area between the road and the lake, was planted up by the Department with such trees as Mango, Sissoo, Erythrina, Bombax, Eucalyptus, Leucaena etc. Another activity on which the Department starts work immediately is to allocate space for building tourist accommodation of various sorts and begin construction as soon as funds become available.

Such activities may or may not adversely affect wild birds that are found at a particular place. On the whole, however, the composition of bird species found at such places, undergoes a change as a result of such actions. For example, in 1977 in the presence of Dr. Sálim Ali, a stretch of about 2 km.s on the banks of the Mula-Mutha in Yerawada, a suburb of Pune, was declared a protected area by the Forest Department of Maharashtra. Shallow water habitats used by a number of migratory birds such as blackwinged stilts, other waders and Garganeys together with resident birds, were thus protected. On the north bank of the river a stony upland with grass and thorn scrub attracted hordes of Yellow Wagtails. I distinctly remember the clouds of wagtails that rose as Dr. Sálim Ali followed by a throng of bird-watchers, arrived on the north bank. However, in subsequent years there was a marked decline in the number of Yellow Wagtails as the Department planted a variety of trees on this plateau. A few wagtails now use fringes of this plateau, while the deciduous forest that occupies most of the flat land attracts arboreal birds such as Koel, Golden Oriole, Coppersmith, Flowerpeckers, and even Green Pigeons that were not found in this 'reserve' before.

Thus by bringing about a change in the habitatat structure at a particular place, the composition of bird-species was also changed. This is neither 'conscious management' nor does it have any scientific basis. But it may not be proper to blame the Department alone for lack of scientific considerations. Many times, voluntary organisations who put up proposals for creation of bird sanctuaries are also tantalizingly vague in their objectives. In most such proposals there is no mention of target species that the proposers want to protect. Instead the proposers usually desire protection to a particular place with all the species that use the gamut of habitats existing at that place. Such place may be a wetland or woodland or a combination of the two. No conscious management, except maintenance of the status quo, may be desired also. However, the maintenance of the status quo does involve management as the balance of existing habitats is likely to change by the very act of declaration of the reserve and also by extraneous forces beyond the control of the manager.

To take the example of the Mula-Mutha bird reserve again: the level of water is crucial to the maintenance of shallow-water habitats used by numerous waders. However, as demand for water for irrigation in the downstream areas increased, more water is now released from the Khadakwasla reservoir upstream. This action flooded and drowned many of the 'wet meadows' used by Snipes. These birds have progressively become rare in the reserve. Also as Pune city expanded, the underground sewage system became overburdened and the quantity of sewage entering the river increased markedly. This changed the water quality, attracting more scavenging birds such as Blackwinged Stilts and Gull-billed Terns that picked up organisms thriving in the fertilised water and driven away such birds as Bronze-winged and Pheasant-tailed Jacana (Gole P. 1984). Moreover, the spread of water hyacinth is increasing year after year, reducing the open water areas used by migratory ducks such as Garganey and Pintail for foraging and resting. The composition of birds and habitats is no longer what it was in 1977 when the reserve was created.

As bird-watching becomes more popular, the demand for protection to particular bird-species and to places used by birds, is going to increase and without conscious management it is going to be difficult to translate these objectives into actual practice. What happens if such management actions are not backed up by scientific considerations and research may be illustrated by the example of Keoladeo Ghana National Park near Bharatpur. There the complete ban on grazing was no doubt prompted by the most worthy consideration of affording total protection to the habitat of birds in the Park. But as it was not backed by any detailed scientific study, it produced certain results that were wholly unpredicted.

It is therefore, evident that in order to produce desired results management actions should be backed by adequate scientific investigation and research. This paper offers certain suggestions to the managers of bird sanctuaries to enable them to carry out studies and organise data that such studies will produce, in such a way as to facilitate decision-making.

The Basic Data:

1. The first requirement will be to know what birds are found at a particular place through the seasons. If the proposal for creation of a bird sanctuary is drawn

up by a group of bird-watchers or a voluntary agency of bird and nature enthusiasts, a list of birds will usually be found to be attached. Some lists will also show status of bird-species, whether they are rare, common, abundant, vagrant etc. and which of them are breeding and which are local or long-distance migrants. If such a list is not enclosed, it is advisable to ask for one or start collecting this information.

2. The next important requirement is to chart the landuse pattern and the character of habitats available. Vegetational details such as dominant plant communities and their successional stages, distribution of vegetation in the area and ecotones should be added to the land-use map of the area.

3. The next step would be to study the habitat-use of different bird-species. The U. S. Dept. of Agriculture, Forest Service classifies habitat use on the basis of the two most important activities of any animal, viz. feeding and reproduction (Sept. 1979). It is not difficult to adapt this system of classification to Indian conditions. In Table 1 a system of classification that may prove suitable to Indian conditions is suggested.

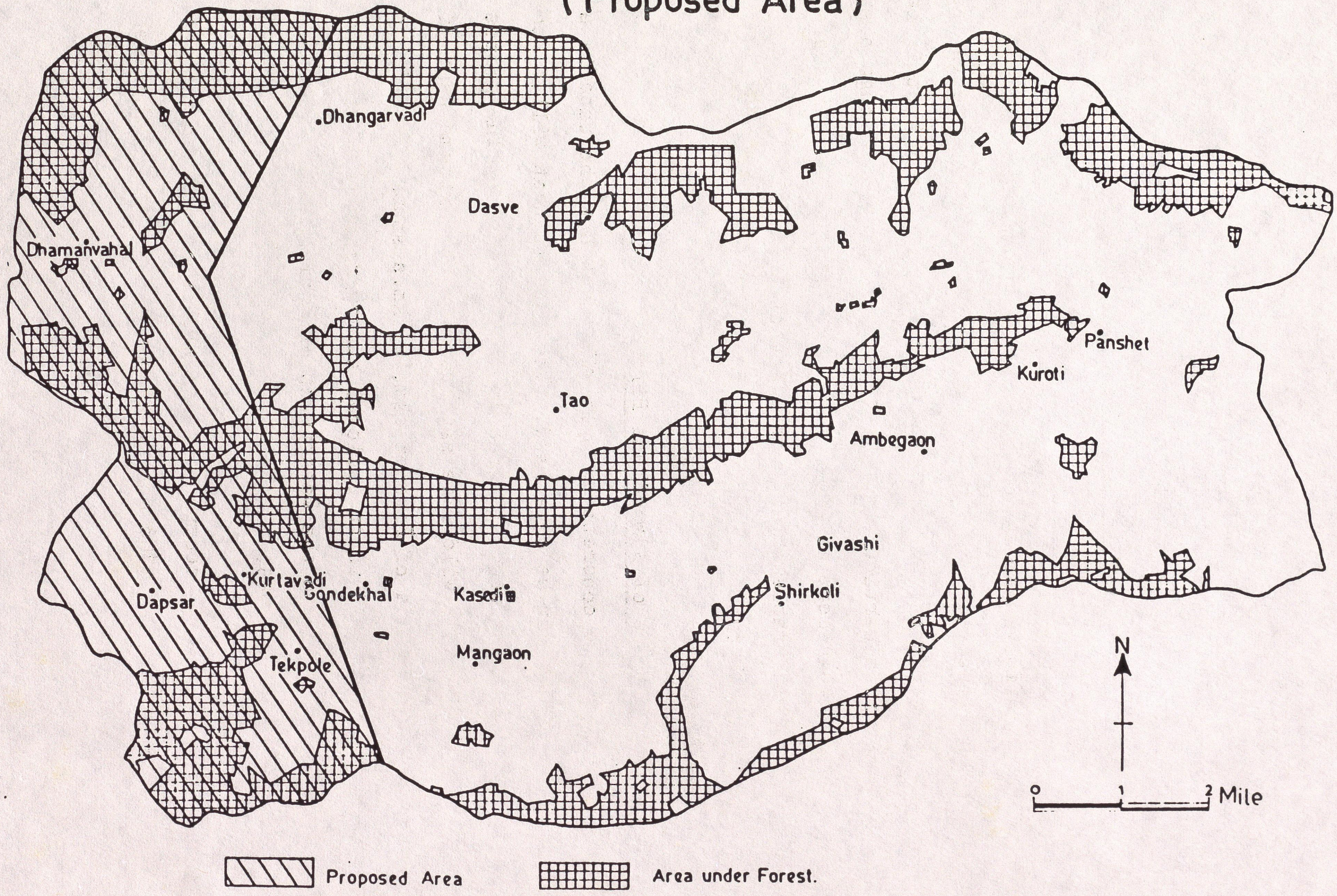
Once information on these three basic requirements is at hand, it can be organised in such a way as to pin-point what effects a particular action will produce. How many species of plants and birds will be affected, how they will be affected and where. If a target species is designated, a particular measure designed to afford it more protection may affect other species. Through the above arrangement of the data, the manager can gauge which other species will be affected and how. A versatility rating is assigned to each species. The most versatile or the least specialised species are generally less affected as they can use other habitats if a particular one becomes unavailable through a specific management action. The least versatile species are more vulnerable and require careful treatment if they are to be preserved.

Example of a Woodland Bird Sanctuary:

A concrete example will show how the data in a particular case can be organised. The example that will be considered is of a woodland area in Western Ghats. The proposal to create a wild-life sanctuary in the extreme west of the catchment area of Panshet dam, 45 km.s south-west of Pune is contained in an ecolocal survey report submitted by Ecological Society to the Department of Environment, Govt. of India in August 1985.

The accompanying map will show the location of this 2387 ha. (5896 acres) proposed sanctuary. The area includes the crest-line of Western Ghats where rainfall annually averages 800 to 900 cm.s. With such an average of rainfall the vegetational climax should be evergreen forest. At one time this indeed was the case as can be deduced from a number

WESTERN GHATS WILDLIFE SANCTUARY
(Proposed Area)



of Sacred Groves scattered in this area. Due to religious sentiments vegetation in these groves was not cut down and these therefore, exhibit specimens of relict vegetation, the type of forest that once dominated this high rainfall area.

Outside the groves however, the original vegetation is now replaced by secondary types as shifting cultivation, making of charcoal, cutting of wood for fuel and house timber and grazing have taken their toll. Most of this area is now occupied by grasses or shrubs or by heavily pollarded or coppiced trees. Certain fruit trees such as Jamun (Syzygium cumini) and Mango (Mangifera indica) are left standing and heavily eroded areas can only support Euphorbia nerrifolia.

Much of the valley land is now submerged under the Panshet reservoir. Lower slopes are cultivated for paddy and the middle are under shifting cultivation. The tops of the hills are reserve forest areas encroached upon, cut up and burnt at many places. The population in this area is however, low, around 600 souls, giving a ratio of one human being for 10 ha. or 25 acres. The survey report prepared by Ecological Society recommends shifting of this population to govt. land near the dam and their resettlement through co-operative dairying and animal husbandry.

The aim of creating a wildlife sanctuary in this area is to afford protection to certain species of plants and animals, birds and insects that are fast disappearing from Western Ghats as evergreen and semi-evergreen forests are cut down.

83 species of the birds have so far been recorded here of which 11 species use the semi-evergreen or evergreen biotope in various ways. Mammals include Barking Deer, Jackal, Porcupine, Wild Boar and Rhesus Macaque.

83 species of birds recorded in this area can be classified into Life Forms categorised in Table 1, according to their use of habitats for reproduction and feeding. This classification is given in Table 2. A majority of bird species (62%) are seen to be covered by life forms 6 and 7 i.e. they use trees for reproduction and feed either on ground, in bushes or trees. Good management of tree cover and more open habitats such as open glades, and shrubs interspersed with trees will prove beneficial to a majority of the species. But the manager needs more information to decide how he should manage these areas - what trees to be maintained, what to be removed and when etc.. He should therefore, know what activities birds carry out through different seasons, which habitat-types they use to carry out these activities and when. It is therefore, necessary that the manager of a Sanctuary should be assisted by competent ornithologists who can gather such information by actual field observation, by netting and ringing birds etc.. In this example ornithologists of Ecological Society were able, in the two-year survey period, to gather information on the occurrence of birds through the seasons and the types of habitat different species use for different activities.

Table No. 3 gives information about the frequency of occurrence of birds in the reserve area. While 32 species both reproduce and feed in the area, the rest use the available habitats for feeding only and reproduce outside the reserve area. Among the birds that breed, 18 species use trees for nesting, 7 use bushes or ground and 6 other nest in varied habitats such as mud-banks, cliffs, holes in trees, ledges etc.. While only 8 species breed in the period June to December, 24 species nest during the first 6 months of the year. With this basic information at hand, the manager can plan his actions in such a way as to cause the least disturbance to breeding birds during the prime breeding season.

However, for intelligent planning of management, more data are obviously required. It is essential to know which habitats, out of the available habitat-pattern, are used by birds for feeding only, for reproduction only and for both feeding and reproduction. Table No. 4 lists the available habitats in the reserve and classifies birds according to how they use them. The highest number of bird species are seen to use riverine vegetation for reproduction as well as feeding. 20 species reproduce in this habitat out of which 18 species use it for reproduction as well as feeding. Another 31 species use this habitat only for feeding. As such in this reserve riverine vegetation demonstrates prime bird use and any action that will disturb this habitat should be avoided and measures should be taken to protect and enrich this vegetation.

Next in importance comes the habitat represented by the tree cover consisting mainly of Syzygium cumini, Mangifera indica, Macaranga peltata and Actinodaphne hookeri. In this example, this tree cover represents Sacred Groves scattered in this area. Protection to these groves will provide protection to 16 breeding birds out of which 13 both reproduce and feed in this habitat; and to 27 other species that only feed there. Third in importance appears to be village environs where fruit trees and bamboo are planted by villagers. Among the more open habitats those represented by Strobilanthus and Dendrocalamus stand out.

To arrive at the Versatility Rating of each bird species, it will be necessary to know the successional stages of vegetation used by different bird species. Vegetational stages that are more or less common to woodland areas are: 1. Grass and forb, 2. Sapling, 3. Pole, 4. Young forest, 5. Mature forest and 5. Aged, declining trees. Though no specific information was collected on the use of successional stages by birds in different habitats, it is possible to give rough indication of such use from work done by ornithologists. Thus the number of species using different successional stages of the plant communities in our example, is as follows:

Successional stage	No. of bird species using it for Reproduction	Feeding
Grass and forb	4	36
Shrub-seedling	0	10
Pole-Sapling	11	22
Young trees	7	42
Mature trees	24	34
Aged, declining trees	5	9

(Species feeding in open water & breeding outside the reserve are excluded.)

Species from each life form can be thus classified according to the dominant plant communities and their successional stages that they use. Now the Versatility Rating will be:

VR = No. of plant communities used for Reproduction + No. of successional stages

Plus

No. of plant communities used for feeding. + No. of successional stages

Different species can now be classified into species with Low, Medium and High VR. In this example the number of species in these three grades are:

Species with Low VR (total score 1 to 5)	34
Species with Medium VR (total score 6 to 10)	39
Species with High VR (total score above 10)	10
Total	83

Steps to reach Management Goals:

In this example, there are 10 versatile species which can utilise a variety of habitats (plant communities and successional stages) and therefore, are likely to be least affected by various management actions. These species include Redwhiskered and Redvented Bulbul, Scimitar and Jungle Babler, Magpie Robin, Shikra, Crow-pheasant, Jungle Crow, Quaker Babbler and Small Green Barbet. These are common species belonging to a variety of habitats including woodland in various stages of growth and decay. The 11 species from semi-evergreen and ever-green forest which need protection in this reserve include: Blue Chat (5), Grey Jungle Fowl (10), Scarlet Minivet (7), Rufous Turtle Dove (3), Emerald Dove (6), Yellowbrowed Bulbul (5), Black Bulbul (9), Yellow-backed Sunbird (5), Brown Wood Owl (10), Small Sunbird (5) and Chest-nut-bellied Nuthatch (4). The brackets show their VR Score. Most of these use mature and old trees for reproduction and feeding. In this reserve Sacred Groves signify such a forest. Protection and maintenance of these groves will no doubt benefit these species. But the expansion of this habitat cannot be the sole aim of the management. Many other species depend on more open habitats. All of them cannot be wished away. But intelligent management may also try eliminating certain unwanted species and attracting others which have vanished due to continued destruction of their habitat. In the present example, species like little Brown Dove, Indian Robin and Green Bee-eater have no place in a high-rainfall area. These species were able to invade the reserve with the creation of xerophytic conditions. The data presented should be able to tell the manager how he can keep controlling their numbers. Likewise the complete absence of Woodpeckers is striking in this example. The manager would do well to keep a certain number of dead and dying trees to attract woodpeckers.

The task of the manager does not end with the conservation of target species. His goal should be the improvement of the overall quality of the reserve in terms of biological diversity. This implies change in the status quo. Indeed the very act of declaration of a reserve tends to change the status quo for it restricts human use of the area. Presentation of the data in the form described so far has equipped the manager with the knowledge of the basic requirements of the birds with whom he would be dealing. This should enable him to be selective - bring about conscious elimination of certain species in preference to certain other species. To judiciously plan his actions he will need more information about the niches occupied by different species, their behaviourial traits, their habits - learned or inherited, their food preferences, the size of their territories or home ranges and specific requirements if any, of each species. The importance of continuous collection of data and research cannot be overemphasised. Management of bird sanctuaries to be effective, will have to be backed by a competent team of ornithologists and ecologists.

Example of a Wetland Bird Sanctuary:

The second example considers management of a proposed wetland reserve. The Mula-Mutha Bird Reserve has already been alluded to. Though over 120 bird-species have been recorded in this reserve so far, 96 species that more commonly occur here are taken for consideration. The reserve area consists of a one and half kilometer stretch of the Mula-Mutha river in the suburb of Yerawada of Pune city. Birds start congregating there every September and remain there in numbers till the river-water rises during the rainy season and the usual shallow water habitats are no longer available. The normal water-level is regained in September. The following broad habitats are available for birds in this reserve:

No.	Name of Habitat	Dominant Plant community
1.	Open Water	Hydrilla verticillata, Lemna gibba, Ceratophylum demersum, Vallisneria spirallis, Potamogeton crispus and P. indicus
2.	Water Edges	Cryptocoryne retrospirallis, Cyperus pangorei, Polygonum glabrum and Typha angustata
3.	Midstream rocks & Islands	Ipomoea sp. Portulata oleracea, Marselia Rorripa indica
4.	Backwaters and pools in rocks	Rotulla tennui
5.	Meadows, wet & dry	Polygonum glabrum, Cynodon dactylon, Alternanthera sessilis
6.	Grass & Scrub	Lantana camara, Acacia arabica
7.	Woodland	Erythrina sp. Cassia sp. Dalbergia sissoo, Leucaena leucocephala.

No target species have been specified by the proposers. However, the reserve is well-known for the numbers of migrants it attracts in winter. These include ducks (Garganey, Pintail and Common Teal), Waders (Blackwinged stilts, Sandpipers & Stints, Greenshank, Ruff & reeve etc.), birds of prey, terns, wagtails etc. Ducks and waders throng the reserve from October to March. A number of resident birds also use the above habitats for feeding and resting or roosting. Species that breed here are however, few viz. Little Brown Dove, Indian Robin, Streaked Fantail and Indian Wren Warbler, Rock Bush Quail, Rain Quail and Little Grebe.

This situation may be considered as typical of all the wetland reserves that have been proposed in recent years.

In the original proposal a list of birds occurring at this place was attached. There have been some changes in the status of certain species over the years and Table No.5&6 lists 96 species that commonly occur at present. A look at the list and the types of habitats available, will make obvious two broad management objectives. These are:

1. To improve the quality of habitats so as to attract greater numbers of migrant birds, and
2. To induce more resident birds to stay and breed in the reserve.

However, the reserve being very close to the city, certain factors which are beyond the control of the manager impinge and have to be considered. These are:

1. Human use: The stretch of the river is used by people for bathing, washing clothes and utensils and for fishing as a non-commercial activity. Birds appear to be used to the presence of the people. Though hunting and trapping are no major threats, a certain amount of grazing by cattle, horses and sheep and goats, is also carried on. However, this has not materially altered the character of any habitat.
2. Quality of the river water and the water level. The quality of water depends on the quantity of sewage

let out in the river by the city. A sewage treatment plant is coming up in the upstream stretches of the river. Once it becomes operational the quality is likely to improve. The water level depends on the quantity of water released from the Khadakwasla reservoir upstream.

3. In recent years Eicohornia crassipes or water hyacinth spreads rapidly during the entire river course through the city as soon as floods recede after the monsoons and the river flow becomes sluggish. The municipal corporation tries to remove it but the efforts to remove it from the Sanctuary area have not been persistent.

It may now be worthwhile to classify birds according to Life Forms. This will bring into focus species that use the same habitats for feeding and reproduction and indicate to the manager diverse species that will be affected if a particular habitat is interfered with. However, reproduction being not an important activity in the reserve at present, resting and/or roosting is considered in its place. A number of migrant birds spend the night in the reserve itself. These include some ducks, Black-winged Stilts, waders, terns etc.. The number of species in different life forms is as follows:

Life Form	1	2	3	4	5	6	7	8	9	10	11	12	13	14
No. of Species	-	3	14	10	14	17	16	-	8	3	2	5	-	4

The frequency of occurrence of different species is given in Table 5&6. 26 species use the reserve for feeding for more than 9 months; 50 species feed here from 5 to 8 months and transients include 20 species that feed in the reserve for 1 to 4 months. Of the 50 species that roost in the reserve, 15 are found from 9 to 12 months, 24 roost from 5 to 8 months and 11 roost from 1 to 4 months. Next let us consider the different plant communities used by birds in different habitats. Information from Table 5 is condensed below:

Habitat No.	1		2		3		4		5		6		7	
	R	F	R	F	R	F	R	F	R	F	R	F	R	F
No. of Species	-	19	14	43	45	48	-	27	1	35	7	47	14	33

The most important resting and roosting habitat appears to be rocks and islands midstream followed by edges of water and woodland. The most important feeding habitats are rocks and islands, scrubland and edges of water, in that order. Midstream rocks and islands is the most important habitat from the point of resting/roosting and feeding.

Steps to meet Management Goals:

The first objective that we have mentioned involves improvement in the quality of the hibitat to attract greater numbers of migrant birds such as ducks and waders. Many of these use mid-streak rocks for resting and roosting, feed in the open water or shallows nearby and also along the edges of river banks. The shallow open water habitat is used by 19 species for feeding. These include a number of migratory ducks. The main threat to this habitat comes from the spread of water hyacinth which tends to cover open water areas from February onwards and practically occupies the whole of it by March end. Its timely removal will benefit ducks and other species that use this habitat. This weed also occupies nooks and crannies, bays and inlets of the river course where the water-flow is sluggish. Thus edges of water are also affected and 14 species that rest/ roost here and 43 species that feed here are faced with problems. Timely removal of this weed will benefit all of them.

The use of the open water habitat by birds is also dependent on the quality of aquatic vegetation. The dominant aquatic plant communities found at present may be the result of increased fertility of water due to greater inflow of sewage. Their food value and use by birds need investigation. Once this information is available the manager can be selective in eliminating some vegetation in preference to some other species with better potential of bird use. Similarly vegetation at the edges of water also needs to be examined from the same point of view.

Besides ducks the other important group of migrants is waders. They feed in shallow water or in mud along the water's edge and some of them roost on rocks mid-stream. In the last few years due to the maintenance of a higher water level, such mud-filled shallow areas have contracted. The manager can examine the edges of water to see if at places such areas can be created.

The second objective mainly concerns resident birds. As already noted the activity of plantation on the north bank has on the whole benefitted the resident birds. Several new species have been attracted though the activity proved inimical to the large flocks of Yellow Wagtail that used the grass and scrub area before it was planted up. Some of the wagtails have now shifted to the eastern extremity of the reserve where this type of habitat is still available to them. The plantation on the north bank can be made more attractive to birds by planting more nectar-producing flower trees, more trees that produce berries and gradually eliminating exotic, quick-growing trees that were planted simply because they grow very quickly.

A look at the habitat-use of birds should convince the manager of the importance of meadows and shrubbery. 8 species use these habitats for roosting while 92 species seek food here. By studying the feeding habits of these birds the manager can enhance the habitats' usefulness to birds. Again certain plant species may have to be eliminated, while planting of certain species can be taken up. The need for a continuous study of birds should once again be emphasised.

The proper management of meadows and shrubland will help birds such as Partridges and Quails and may attract other ground-nesting birds as well as birds that nest in shrubs. However, solitude and absence of disturbance are necessary to ensure breeding success. The manager will do well to keep certain pockets away from human disturbance. Likewise near the water's edge pockets of dense Typha or other water-side thickets will provide shelter and breeding places for Coot, Indian and Purple Moorhen etc.

At present the number of breeding species is low and tree-nesters are even fewer. But as the forest on the north bank matures it may provide suitable places for some more species. However, between the sanctuary and the private estate further to the north, there is a buffer zone which provides the necessary solitude to nesting birds. This is not yet adequately planted up. If suitable nesting trees such as Ficus, Acacia etc. are planted here, they may eventually provide nesting space to such colonial nesters as Cormorants, Egrets, Herons and Storks. However, these will not breed unless adequate food is made available to feed their nestlings. The manager should consult fisheries experts to enable him to augment fish in river waters.

The basic data that are presented here thus provide the manager a working base on which to build up his management practices. Continuous research on birds that are placed under his care will open up new vistas and suggest novel ideas that will enrich his experience and place newer tools in his hands to reach management goals. His task becomes immensely easier if he is backed by a team of competent ornithologists. For the development of the science of Bird Sanctuary Management, it is necessary to attract this unfeathered biped who alone can study 'feathered bipeds'.

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Table No. 1

CLASSIFYING WILD FAUNA ACCORDING TO LIFE FORMS

A C T I V I T Y

Life Form	Reproduction or Roosting	Feeding
1	In water	In water
2	On and around water	In water
3	In and around water	In and around water
4	In grass or bushes around water	In and around water
5	On ground among rocks, grass or in cultivation	Among rocks, grass, in cultivation or in water
6	In bushes or in medium high trees	On ground, in bushes or trees in water or in air
7	In tall deciduous or evergreen trees	On ground, in bushes or trees, in and around water or in air
8	In coniferous trees	On ground, in bushes or trees, around water or in air
9	In a burrow in mud-cliffs, rock-faces, and ledges along water courses	On ground, in water or in air
10	On rock cliffs, ledges or in caves	On the ground or in air
11	In an excavated hole in a tree	On the ground, in bushes or trees or in air
12	In a hole or nest in a tree made by another species	On ground, in bushes or trees or in air
13	In a hole or burrow underground	On ground, in water or in bushes or trees
14	In a hole or ledge in a man-made structure	On ground, in bushes or trees or in air

TABLE NO. 2

WESTERN GHATS WILDLIFE SANCTUARY (PROPOSED) : CLASSIFICATION OF BIRDS ACCORDING TO LIFE FORMS

L I F E F O R M S

One	Three	Four	Five	Six	Seven	Nine	Ten	Eleven	Twelve
Blackheaded Gull	Grey	Spotbill	Jungle	Pond	Shikra	Honey	Tawney	Small	Collared
	Wagtail	Duck	Bush	Heron	Sparrow-	Buzzard	Eagle	Green	Scope
	Large	White-	Quail	Cattle	hawk	Small	Longbilled	Barbet	Owl
	Pied	breasted	Red	Egret	Crested	Blue	Vulture		Brown
	Wagtail	waterhen	Spur-	Black-	Hawk	Kingfisher	Shaheen		Fish
		Blue	fowl	winged	Eagle	Whitebrea-	Falcon		Owl
		Chat	Redwatt-	Kite	Booted	sted	Blue		Spotted
			led	Grey	Hawk	Kingfisher	Rock		Owlet
			Lapwing	Jungle	Eagle	Green	Pigeon		Brown
			Indian	Fowl	White-	Bee-eater	Great		Wood
			Robin	Little	backed	Wiretailed	Horned		Owl
			Orange-	Brown	Vulture	Swallow	Owl		Grey-
			headed	Dove	Crested	Malabar	Alpine		headed
			Ground	Baybacked	Serpent	Whistling	Swift		Myna
			Thrush	Shrike	Eagle	Thrush	Crag		Jungle
				Rufous-	Osprey		Martin		Myna
				backed	Kestrel				Brahminy
				Shrike	Rufous				Myna
				Black-	Turtle				
				headed	Dove				
				Cuckoo	Emerald				
				Shrike	Dove				
				Scarlet	Crow-				
				Minivet	pheasant				
				Redwhis-	Jungle				
				kered	Nightjar				
				Bulbul	Crested				
				Redven-	Tree				
				ted	Swift				

Table No. 2 (contd.)

LIFE FORMS									
One	Three	Four	Five	Six	Seven	Nine	Ten	Eleven	Twelve
				Bulbul Spotted Babbler Scimitar Babbler Rufous Babbler Jungle Babbler Verditer Flycatcher Paradise Flycatcher Blacknaped Flycatcher Chiffchaff Leaf Warbler Magpie Robin Pied Bush Chat Bluehead- ed Rock Thrush Blackbird Common Rosefinch	Golden Oriole Grey Drongo Jungle Crow Yellow- browed Bulbul Black Bulbul Quaker Babbler Greyheaded Flycatcher Yellow- cheeked Tit Chestnut- bellied Nuthatch TreePipit Thickbilled Flowerpecker Tickell's Flowerpecker Small Sunbird Yellowbacked Sunbird				

Table No. 3

PROPOSED WESTERN GHATS WILDLIFE SANCTUARY : FREQUENCY OF OCCURRENCE

R = Reproduction F = Feeding

Life Form	Name of Bird	Month of the Year 1	2	3	4	5	6	7	8	9	10	11	12
1	Blackheaded Gull	-	-	-	-	-	-	-	-	-	F	F	F
3	Grey Wagtail	F	F	-	-	-	-	-	-	F	F	F	F
4	Spotbill Duck	-	-	-	-	-	-	-	-	-	F	F	F
	Whitebreasted Waterhen	F	F	F	F	F	-	-	-	RF	RF	F	F
	Blue Chat	F	F	F	F	F	-	-	-	-	-	F	F
5	Jungle Bush Quail	F	F	F	F	F	-	-	-	F	F	F	F
	Red Spurfowl	F	F	RF	RF	F	-	-	-	F	F	F	F
	Redwattled Lapwing	F	F	F	F	F	-	-	-	-	F	F	F
	Indian Robin	F	F	F	RF	RF	-	-	-	-	F	F	F
	Ground Thrush	F	F	F	RF	RF	F	-	-	-	F	F	F
6	Pond Heron	F	F	F	F	F	-	-	-	-	F	F	F
	Cattle Egret	F	F	F	F	F	-	-	-	F	F	F	F
	Blackwinged Kite	F	F	F	F	F	-	-	-	-	F	F	F
	Grey Jungle Fowl	F	F	F	RF	RF	RF	F	F	F	F	F	F

Table No. 3 (contd.)

Life Form	Name of Bird	Month of the Year											
		1	2	3	4	5	6	7	8	9	10	11	12
6	Little Brown Dove	F	F	F	F	F	-	-	-	-	-	F	F
	Baybacked Shrike	F	F	F	F	F	-	-	-	-	F	F	F
	Rufousbacked Shrike	F	F	F	F	F	-	-	-	-	F	F	F
	Blackheaded Cuckoo Shrike	F	F	F	RF	RF	-	-	-	F	F	F	F
	Scarlet Minivet	F	F	RF	RF	F	-	-	F	F	F	F	F
	Redwhiskered Bulbul	F	F	RF	RF	RF	-	-	RF	RF	F	F	
	Redvented Bulbul	F	F	RF	RF	F	-	-	F	F	F	F	
	Spotted Babbler	F	F	RF	RF	F	-	-	-	F	F	F	
	Scimitar Babbler	F	F	RF	RF	RF	F	F	F	F	F	F	F
	Rufous Babbler	F	F	F	F	F	-	-	-	-	F	F	F

Table No. 3 (contd.)

Life Form	Name of Bird	1	2	3	4	5	6	7	8	9	10	11	12
		Month	of	the	Year								
6	Jungle Babbler	F	F	F	F	F	-	-	-	-	F	F	F
	Verditer Flycatcher	F	F	F	-	-	-	-	-	-	-	F	F
	Paradise Flycatcher	F	F	F	RF	RF	-	F	F	F	F	F	F
	Blacknaped Flycatcher	F	F	F	F	F	-	-	-	-	F	F	F
	Chiffchaff	F	F	F	-	-	-	-	-	-	-	F	F
	Leaf Warbler	F	F	F	-	-	-	-	-	-	F	F	F
	Magpie Robin	F	F	RF	RF	RF	-	-	-	F	F	F	F
	Pied Bush Chat	F	F	RF	RF	RF	-	-	-	F	F	F	F
	Blueheaded Rock Thrush	F	F	F	F	F	-	-	-	-	F	F	F
	Blackbird	F	F	F	F	F	-	-	-	-	-	F	F
	Common Rosefinch	F	F	F	F	F	-	-	-	-	-	F	F
7	Shikra	F	F	F	F	F	-	-	-	F	RF	RF	RF
	Sparrowhawk	F	F	F	F	F	-	-	-	-	F	F	F
	Crested Hawk Eagle	F	F	F	F	F	-	-	-	-	-	F	F
	Booted Hawk Eagle	F	F	-	-	-	-	-	-	-	-	F	F

Table No. 3 (contd.)

Life Form	Name of Bird	Month of the Year											
		1	2	3	4	5	6	7	8	9	10	11	12
7	Whitebacked Vulture	F	F	F	F	F	-	-	-	-	F	F	F
	Crested Serpent Eagle	F	RF	RF	RF	F	-	-	-	F	F	F	F
	Osprey	F	F	-	-	-	-	-	-	-	F	F	F
	Kestrel	F	F	F	-	-	-	-	-	F	F	F	F
	Rufous Turtle Dove	F	F	F	F	F	-	-	-	-	F	F	F.
	Emerald Dove	F	F	F	RF	RF	RF	-	-	F	F	F	F
	Crow-pheasant	F	F	F	F	F	F	-	-	RF	RF	F	F
	Jungle Nightjar	F	F	RF	RF	RF	-	-	-	F	F	F	F
	Crested Tree Swift	F	F	F	RF	RF	-	-	--	F	F	F	F
	Golden Oriole	F	F	F	F	F	-	-	-	-	F	F	F
	Grey Drongo	F	F	RF	RF	RF	-	-	-	F	F	F	F
	Jungle Crow	F	F	F	F	F	F	F	RF	RF	F	F	F
	Yellowbrowed Bulbul	F	F	F	F	F	-	-	-	-	F	F	F
	Black Bulbul	F	F	F	F	RF	RF	-	-	-	F	F	F
	Quaker Babbler	F	F	F	F	RF	RF	-	-	F	F	F	F
	Greyheaded Flycatcher	F	F	F	-	-	-	-	-	-	F	F	F

Table No. 3 (contd.)

Life Form	Name of Bird	Month of the Year 1	2	3	4	5	6	7	8	9	10	11	12
7	Yellowchecked Tit	F	F	F	F	F	-	-	-	F	F	F	F
	Chestnutbellied Nuthatch	F	F	F	-	-	-	-	-	-	-	F	F
	Tree Pipit	F	F	F	-	-	-	-	-	-	F	F	F
	Thickbilled Flowerpecker	F	F	F	-	-	-	-	-	F	F	F	F
	Tickell's Flowerpecker	F	F	F	-	-	-	-	-	-	F	F	F
	Small Sunbird	F	F	F	F	F	-	-	-	F	F	F	F
	Yellowbacked Sunbird	F	F	F	F	F	-	-	-	F	F	F	F
9	Honey Buzzard	F	F	F	F	F	-	-	-	-	-	F	F
	Small Blue Kingfisher	F	F	F	F	F	F	-	-	-	RF	RF	F
	Whitebreasted Kingfisher	F	F	F	F	F	-	-	-	F	F	F	F

Table No. 3 (contd.)

Life Form	Name of Bird	Month of the Year											
		1	2	3	4	5	6	7	8	9	10	11	12
9	Green Bee-eater	F	F	F	F	F	-	-	-	-	F	F	F
	Wiretailed Swallow	F	F	F	F	F	-	-	-	-	F	F	F
10	Tawny Eagle	F	F	F	F	F	-	-	-	-	-	F	F
	Longbilled Vulture	F	F	F	F	F	-	-	-	-	F	F	F
	Shaheen Falcon	F	F	F	F	F	-	-	-	-	F	F	F
	Blue Rock Pigeon	F	F	F	F	F	-	-	-	-	F	F	F
	Great Horned Owl	F	RF	RF	F	F	-	-	-	F	F	F	F
	Alpine Swift	F	F	F	F	F	-	-	-	F	F	F	F
	Crag Martin	F	F	F	-	-	-	-	-	-	F	F	F
11	Small Green Barbet	F	F	RF	RF	RF	-	-	-	F	F	F	F
12	Collared Scops Owl	F	F	F	F	-	-	-	-	-	F	F	F
	Brown Fish Owl	F	F	F	F	F	-	-	-	F	F	F	F
	Spotted Owlet	F	F	F	-	-	-	-	-	-	F	F	F
	Brown Wood Owl	F	F	F	F	F	F	-	-	F	RF	RF	RF
	Greyheaded Myna	-	-	-	F	F	-	-	-	-	-	-	-
	Jungle Myna	F	F	F	F	F	-	-	-	-	F	F	F
	Brahminy Myna	F	F	F	F	F	-	-	-	-	-	F	F

Table No. 4

PROPOSED WESTERN GHATS WILDLIFE SANCTUARY : HABITAT-USE OF BIRDS

R = Reproduction F = Feeding

Life Form	Name of Bird	Open Water	Water Edges	Riverine Vegetation	Village Environs	Woodfordia Lasiosiphon Xeromphis	Strobilanthus Butes Emblica	Syzygium Mangifera Macaranga Actinodaphne	Erythrina Euphorbia Memecylon	Dendrocalamus Phoenix Glochiodion
1	Blackheaded Gull	F	-	-	-	-	-	-	-	-
3	Grey Wagtail	-	F	F	-	-	-	-	-	-
4	Spotbill Duck	F	F	-	-	-	-	-	-	-
	Whitebreasted Waterhen	-	RF	RF	F	-	-	F	-	-
	Blue Chat	-	-	F	-	-	-	F	-	-
5	Jungle Bush Quail	-	-	-	-	F	F	-	-	F
	Red Spurfowl	-	-	-	-	F	RF	-	F	RF
	Redwattled Lapwing	-	F	-	F	-	-	-	F	-
	Indian Robin	-	-	-	RF	F	-	-	-	-
	Ground Thrush	-	-	RF	F	-	-	RF	-	F
6	Pond Heron	-	F	F	F	-	-	-	-	-
	Cattle Egret	-	F	F	F	-	-	-	-	-

Table No. 4 (contd.)

Life Form	Name of Bird	Open Water	Water Edges	Riverine Vegetation	Village Environs	Woodfordia Lasiosiphon Xeromphis	Strobilanthus Butea Emblica	Syzygium Mangifera Macaranga Actinodaphne	Erythrina Euphorbia Memecylon	Dendrocalamus Phoenix Glochiodion
6	Blackwinged Kite	-	-	-	-	F	F	-	-	F
	Grey Jungle Fowl	-	-	-	-	-	RF	F	-	F
	Little Brown Dove	-	-	-	F	F	-	-	-	-
	Baybacked Shrike	-	-	-	F	F	-	--	F	-
	Rufousbacked Shrike	-	-	-	F	F	F	-	F	-
	Blackheaded Cuckoo Shrike	-	-	RF	F	-	-	RF	F	-
	Scarlet Minivet	-	-	-	-	-	-	RF	F	F
	Redwhiskered Bulbul	-	-	RF	F	F	RF	F	F	F
	Redvented Bulbul	-	-	F	RF	F	RF	-	F	F
	Spotted Babbler	-	-	F	-	-	RF	R	F	RF
	Scimitar Babbler	-	-	RF	F	-	F	RF	-	-
	Rufous Babbler	-	-	-	-	F	F	-	-	F

Table No. 4 (contd.)

Life Form	Name of Bird	Open Water	Water Edges	Riverine Vegetation	Village Environ	Woodfordia Lasiosiphon Xeromphis	Strobilanthus Butea Emblica	Syzygium Mangifera Macaranga Actinodaphne	Erythrina Euphorbia Memecylon	Dendrocalamus Phoenix Glochiodion
6	Jungle Babbler	-	-	-	-	F	F	-	-	F
	Verditer Flycatcher	-	-	F	F	-	-	F	F	-
	Blacknaped Flycatcher	-	-	F	-	-	-	F	-	F
	Chiffchaff	-	-	-	F	F	F	-	F	F
	Leaf warbler	-	-	-	F	F	F	-	F	F
	Magpie Robin	-	-	RF	RF	-	-	F	F	F
	Pied Bush Chat	-	-	-	RF	F	RF	-	F	F
	Blueheaded Rock Thrush	-	-	F	-	-	F	F	-	-
	Blackbird	-	-	F	F	-	-	F	F	-
	Common Rosefinch	-	-	F	F	-	F	-	-	F
7	Shikra	-	-	RF	-	-	-	RF	F	F
	Sparrowhawk	-	-	F	F	-	--	F	F	F
	Crested Hawk Eagle	-	-	-	-	F	F	F	-	F
	Booted Hawk Eagle	-	-	-	-	F	F	-	-	F

Table No. 4 (contd.)

Life Form	Name of Bird	Open Water	Water Edges	Riverine Vegetation	Village Environs	Woodfordia Lasiosiphon Xeromphis	Strobilanthus Butea Emblica	Syzygium Mangifera Macaranga Actinodaphne	Erythrina Euphorbia Memecylon	Dendrocalamus Phoenix Glochiodion
7	Whitebacked Vulture	-	-	-	F	F	-	-	-	-
	Crested Serpent Eagle	-	-	F	-	-	F	R	F	RF
	Osprey	F	F	-	-	-	-	-	-	-
	Kestrel	-	-	-	F	-	F	-	F	F
	Rufous Turtle Dove	-	-	F	-	-	-	F	-	-
	Emerald Dove	-	-	RF	-	-	-	RF	-	-
	Crow-pheasant	-	-	RF	RF	-	F	F	F	F
	Jungle Nightjar	-	-	RF	F	-	F	RF	F	-
	Crested Tree Swift	-	-	RF	F	-	F	-	R	F
	Golden Oriole	-	-	F	F	-	-	-	F	F
	Grey Drongo	-	-	RF	-	-	-	RF	F	-
	Jungle Crow	-	-	RF	RF	-	-	F	F	F
	Yellowbrowed Bulbul	-	-	F	-	-	-	F	-	-
	Black Bulbul	-	-	F	F	-	-	RF	F	-

Table No. 4 (contd.)

Life Form	Name of Bird	Open Water	Water Edges	Riverine Vegetation	Village Environs	Woodfordia Lasiosiphon Xeromphis	Strobilanthus Butea Emblica	Syzygium Mangifera Macaranga Actinodaphne	Erythrina Euphorbia Memecylon	Dendrocalamus Phoenix Glochiodion
7	Quaker Babbler	-	-	RF	F	-	F	RF	F	F
	Greyheaded Flycatcher	-	-	F	-	-	-	F	-	-
	Yellowcheeked Tit	-	-	F	F	-	-	F	-	-
	Chestnutbellied Nuthatch	-	-	F	-	-	-	F	-	-
	Tree Pipit	-	-	F	-	-	F	-	F	-
	Thickbilled Flowerpecker	-	-	F	F	-	-	F	-	-
	Tickell's Flowerpecker	-	-	F	F	-	-	F	-	-
	Small Sunbird	-	-	F	F	-	-	F	-	-
	Yellowbacked Sunbird	-	-	F	F	-	-	F	-	-
9	Honey Buzzard	-	-	-	-	F	F	-	F	F
	Small Blue Kingfisher	-	RF	RF	-	-	-	-	-	-
	Whitebreasted Kingfisher	-	F	F	F	-	-	-	F	-
	Green Bee-eater	-	-	-	F	F	-	F	F	4

Table No. 4 (contd.)

Life Form	Name of Bird	Open Water	Water Edges	Riverine Vegetation	Village Environs	Woodfordia Lasiosiphon Xeromphis	Strobilanthus Butea Emblica	Syzygium Mangifera Macaranga Actinodaphne	Erythrina Euphorbia Memecylon	Dendrocalamus Phoenix Glochiodion
9	Wiretailed Swallow	F	F	F	-	-	-	-	-	-
10	Tawny Eagle	-	-	-	F	F	F	-	F	F
	Longbilled Vulture	-	-	-	F	F	-	-	-	-
	Shaheen Falcon	-	F	-	-	F	F	-	F	F
	Blue Rock Pigeon	-	-	-	F	F	-	-	-	-
	Great Horned Owl	-	-	F	F	F	-	-	-	RF
	Alpine Swift	-	-	-	-	-	F	F	F	F
	Crag Martin	F	F	-	-	F	F	-	-	F
11	Small Green Barbet	-	-	RF	F	-	F	RF	F	F
12	Collared Scops Owl	-	-	F	-	-	-	F	-	-
	Brown Fish Owl	F	F	F	-	-	-	-	-	-
	Spotted Owlet	-	-	-	F	-	-	-	-	-
	Brown Wood Owl	-	-	F	F	-	-	RF	F	-
	Greyheaded Myna	-	-	-	-	-	-	F	-	-
	Jungle Myna	-	-	F	F	-	-	F	F	F
	Brahminy Myna	-	-	-	F	-	F	-	F	-

Table No. 5

MULA-MUTHA RIVER BIRD SANCTUARY (PROPOSED)

CLASSIFICATION OF BIRDS ACCORDING TO LIFE FORM & FREQUENCY OF OCCURRENCE

F = Feeding R = Roosting/Resting

Life Form	Name of Bird	Months of the year											
		1	2	3	4	5	6	7	8	9	10	11	12
7	Little Cormorant	F	F	F	F	-	-	-	F	F	F	F	F
7	Little Egret	F	F	F	F	F	F	-	-	-	F	F	F
7	Grey Heron	F	F	F	F	F	-	-	-	F	F	F	F
7	Cattle Egret	F	F	F	F	F	F	-	-	-	F	F	F
7	Pond Heron	F	F	F	F	F	F	-	-	F	F	F	F
7	Night Heron	F	F	F	F	F	-	-	-	-	F	F	F
7	Whitenecked Stork	F	F	F	-	-	-	-	-	F	F	F	F
6	Openbilled Stork	F	F	F	-	-	-	-	-	-	-	-	F
4	Spotbill Duck	F	F	F	-	-	-	-	-	F	-	-	F
2	Shoveller	F	F	F	-	-	-	-	-	-	-	-	F
2	Little Grebe	F	RF	RF	F	F	F	-	-	F	F	F	F
3	Pintail	F	F	F	-	-	-	-	-	-	F	F	F
3	Common Teal	F	F	F	-	-	-	-	-	-	-	F	F
3	Garganey	F	F	F	F	-	-	-	-	F	F	F	F
10	Scavenger Vulture	F	F	-	-	F	-	-	-	-	-	-	F

Table No. 5 (contd.)

Life Form	Name of Bird	Months of the Year											
		1	2	3	4	5	6	7	8	9	10	11	12
6	Blackwinged Kite	F	F	F	F	-	-	-	-	F	F	F	F
7	Pariah Kite	F	F	F	F	F	F	-	-	F	F	F	F
4	Marsh Harrier	F	F	F	-	-	-	-	-	-	F	F	F
6	White-eyed Buzzard	F	F	F	F	-	-	-	-	-	F	F	F
10	Redheaded Merlin	F	F	F	-	-	-	-	-	-	F	F	F
7	Kestrel	F	F	F	-	-	-	-	-	F	F	F	F
5	Painted Partridge	-	-	-	-	-	-	F	F	F	-	-	-
5	Grey Partridge	F	F	-	-	-	-	-	-	-	F	F	F
4	Rain Quail	-	-	-	-	-	F	F	F	F	-	-	-
5	Jungle Bush Quail	-	-	-	-	-	F	F	F	F	F	-	-
5	Rock Bush Quail	F	F	F	F	F	-	-	-	-	F	F	F
4	Indian Moorhen	F	F	-	-	-	-	-	-	-	F	F	F
6	Whitebreasted Waterhen	F	F	-	-	-	-	-	-	F	F	F	F
4	Purple Moorhen	F	F	F	-	-	-	-	-	F	F	F	F
3	Coot	F	F	F	F	-	-	-	-	F	F	F	F
4	Painted Snipe	F	F	-	-	-	-	F	F	F	F	-	-
2	Pheasant-tailed Jacana	-	-	F	F	F	F	-	-	-	-	-	-

Table No. 5 (contd.)

Life Form	Name of Bird	Months of the Year											
		1	2	3	4	5	6	7	8	9	10	11	12
5	Redwattled Lapwing	F	F	F	F	F	F	F	F	F	F	F	F
3	Little Ringed Plover	F	F	F	F	F	-	-	-	-	-	F	F
3	Kentish Plover	F	F	F	F	-	-	-	-	-	-	F	F
3	Ruff & Reeve	F	F	F	-	-	-	-	-	-	F	F	F
3	Common Sandpipier	F	F	F	F	F	-	-	F	F	F	F	F
3	Green-shank	F	F	F	F	-	-	-	-	F	F	F	F
3	Little Stint	F	F	F	-	-	-	-	-	-	F	F	F
3	Temminck's Stint	F	F	F	-	-	-	-	-	-	F	F	F
4	Common Snipe	F	F	F	-	-	-	-	-	-	-	F	F
3	River Tern	F	F	F	F	-	-	-	-	-	F	F	F
3	Gullbilled Tern	F	F	F	F	-	-	-	-	F	F	F	F
7	Shikra	F	F	F	-	-	-	-	-	-	-	F	F
14	Blue Rock Pigeon	F	F	F	F	F	F	F	F	F	F	F	F
6	Little Brown Dove	F	F	F	F	RF	RF	F	F	F	F	F	F
6	Koel	F	F	F	F	F	F	-	-	F	F	F	F
7	Crow-pheasant	F	F	F	-	-	-	-	-	F	F	F	F
6	Hawk-cuckoo	-	-	-	-	-	F	F	F	F	F	F	F
11	Coppersmith	F	F	F	F	-	-	-	-	-	F	F	F

Table No. 5 (contd.)

Life Form	Name of Bird	Months of the Year											
		1	2	3	4	5	6	7	8	9	10	11	12
7	Plaintive Cuckoo	-	-	-	-	-	F	F	-	-	-	-	-
12	Spotted Owlet	F	F	-	-	-	-	-	-	-	-	-	F
14	House Swift	F	F	F	F	-	-	-	F	F	F	F	F
14	Hoopoe	F	F	F	F	F	-	-	-	F	F	F	F
6	Indian Roller	F	F	F	-	-	-	-	-	-	-	-	F
3	Blackwinged Stilt	F	F	F	F	-	-	-	-	F	F	F	F
9	Small Green Bee-eater	F	F	F	F	F	F	-	-	-	F	F	F
9	Pied Kingfisher	F	F	F	-	-	-	-	-	F	F	F	F
9	Small Blue Kingfisher	F	F	F	F	-	-	-	-	F	F	F	F
9	White-breasted Kingfisher	F	F	F	F	F	-	-	-	-	F	F	F
11	Grey Hornbill	F	F	F	-	-	-	-	-	-	F	F	F
6	Wryneck	F	F	-	-	-	-	-	-	-	-	-	F
4	Yellow Wagtail	F	F	F	F	-	-	-	-	F	F	F	F
5	Indian Pipit	F	F	-	-	-	-	-	-	-	-	F	F
9	Redrumped Swallow	F	F	F	F	-	-	-	-	F	F	F	F
9	Wiretailed Swallow	F	F	F	F	-	-	-	-	F	F	F	F
9	Common Swallow	F	F	F	F	-	-	-	-	-	F	F	F

Table No. 5 (contd.)

Life Form	Name of Bird	Months of the Year											
		1	2	3	4	5	6	7	8	9	10	11	12
6	Baybacked Shrike	F	F	F	-	-	-	-	-	-	-	F	F
6	Rufousbacked Shrike	F	F	F	F	F	F	-	-	-	F	F	F
7	King Crow	F	F	F	F	F	F	-	-	F	F	F	F
7	Golden Oriole	F	F	F	-	-	-	-	-	-	-	F	F
12	Common Myna	F	F	F	F	F	F	F	F	F	F	F	F
12	Brahminy Myna	F	F	F	F	F	-	-	F	F	F	F	F
7	Jungle Crow	F	F	F	F	F	RF	RF	RF	F	F	F	F
7	House Crow	F	F	F	F	F	F	F	F	F	F	F	F
12	Grey Tit	F	F	-	-	-	-	F	F	F	-	-	-
6	Redvented Bulbul	F	F	F	F	F	F	RF	RF	RF	F	F	F
12	Jungle Myna	F	F	F	F	F	-	-	-	-	-	-	F
6	Large Grey Babbler	F	F	F	F	F	-	-	-	-	F	F	F
4	Bluethroat	F	F	F	-	-	-	-	-	-	-	-	F
5	Streaked Fantail Warbler	-	-	-	-	-	-	RF	RF	F	-	-	-
5	Indian Wren warbler	-	-	-	-	-	F	RF	RF	F	F	-	-
6	Ashy Wren Warbler	F	F	F	F	F	F	RF	RF	F	F	F	F
6	Tailor-Bird	-	-	-	-	-	F	RF	RF	F	F	-	-
5	Indian Robin	F	F	F	F	RF	RF	F	F	F	F	F	F

Table No. 5 (contd.)

Life Form	Name of Bird	Months of the Year											
		1	2	3	4	5	6	7	8	9	10	11	12
10	Blue Rock Thrush	F	F	F	-	-	-	-	-	-	-	-	F
5	Stonechat	F	F	F	-	-	-	-	-	-	-	-	F
4	Yellowheaded Wagtail	F	F	F	-	-	-	-	-	-	-	-	-
5	White Wagtail	F	F	F	-	-	-	-	-	-	-	-	F
9	Large Pied Wagtail	F	F	F	F	F	F	F	F	F	F	F	F
5	Rufous-tailed Finch-lark	F	F	F	F	F	-	-	-	-	F	F	F
6	Weaver Bird	-	-	-	-	F	F	RF	RF	RF	-	-	-
6	White-throated Munia	-	F	F	F	F	-	-	-	-	-	-	-
5	Blackheaded Munia	-	-	-	-	F	F	-	-	-	-	-	-
5	Red Munia	-	F	F	F	F	-	-	-	-	-	-	-
14	House Sparrow	F	F	F	F	F	F	F	F	F	F	F	F

Table No. 6

MULA-MUTHA RIVER BIRD SANCTUARY (PROPOSED)

CLASSIFICATION OF BIRDS ACCORDING TO HABITAT-USE

F = Feeding   R = Roosting/Resting

Life Form	Name of Bird	NATURE OF HABITAT						
		Open Water Hydrilla Lemna Ceratophy-lum Vallisne-ria Potamoge-ton	Water edges Crypto-coryne Cyperus Plygonum Typha	Rocks midstream Ipomoea Marselia Portulata Rorripa	Back-waters Rotulla Tennuis	Meadows Polygonum Cynodon Alternan-thera	Scrub-land Acacia arabica Lanatana camara	Woodland Erythrina Cassia Bauhinia Leucaena
7	Little Cormorant	F	-	R	-	-	-	-
7	Little Egret	-	F	RF	F	F	-	-
7	Grey Heron	-	F	RF	F	-	-	-
7	Cattle Egret	-	F	RF	F	F	F	-
7	Pond Heron	-	RF	RF	F	F	-	-
7	Night Heron	-	F	-	-	F	-	-
7	Whitenecked Stork	-	F	F	-	F	-	-
6	Openbilled Stork	-	F	F	-	-	-	-
4	Spotbill Duck	F	RF	RF	-	-	-	-
2	Shoveller	F	RF	R	-	-	-	-

Table No. 6 (contd.)

MULA-MUTHA RIVER BIRD SANCTUARY (PROPOSED)

CLASSIFICATION OF BIRDS ACCORDING TO HABITAT-USE

Life Form	Name of Bird	NATURE OF HABITAT						
		Open water	Water edges	Rocks midstream	Back-Waters	Meadows	Scrub land	Woodland
2	Little Grebe	F	RF	-	-	-	-	-
3	Pintail	F	RF	RF	-	-	-	-
3	Common Teal	F	RF	RF	-	-	-	-
3	Garganey	F	RF	RF	F	-	-	-
10	Scavenger Vulture	-	-	-	-	F	-	
6	Blackwinged Kite	-	-	-	-	-	F	F
7	Pariah Kite	-	-	RF	F	F	F	-
4	Marsh Harrier	-	F	RF	-	F	-	-
6	White-eyed Buzzard	-	-	-	-	-	F	RF
10	Redheaded Merlin	-	-	F	-	-	F	RF
7	Kestrel	-	-	-	-	-	F	RF
5	Painted Partridge	-	-	-	-	-	RF	R
5	Grey Partridge	-	-	-	-	F	F	R
4	Rain Quail	-	F	-	-	F	RF	-
5	Jungle Bush Quail	-	-	-	-	F	F	RF
5	Rock Bush Quail	-	-	-	-	F	F	-
4	Indian Moorhen	F	F	RF	-	-	-	-

Table No. 6 (contd.)

MULA-MUTHA RIVER BIRD SANCTUARY (PROPOSED)

CLASSIFICATION OF BIRDS ACCORDING TO HABITAT-USE

Life Form	Name of Bird	NATURE OF HABITAT						
		Open Water	Water edges	Rocks Midstream	Back-Waters	Meadows	Scrub land	Woodland
6	Whitebreasted Waterhen	-	F	RF	F	-	-	-
4	Purple Moorhen	-	F	RF	-	-	-	-
3	Coot	F	RF	RF	-	-	-	-
4	Painted Snipe	-	RF	RF	-	F	-	-
2	Pheasant-tailed Jacana	F	RF	RF	-	-	-	-
5	Redwattled Lapwing	-	RF	RF	F	F	F	-
3	Little Ringed Plover	-	F	RF	F	-	-	-
3	Kentish Plover	-	F	RF	F	-	-	-
3	Ruff & Reeve	-	F	RF	F	-	-	-
3	Common Sandpipier	-	F	RF	F	F	-	-
3	Green-shank	-	F	RF	F	-	-	-
3	Little Stint	-	F	RF	F	-	-	-
3	Temminck's Stint	-	F	RF	F	-	-	-
4	Common Snipe	-	F	RF	-	RF	-	-
3	River Tern	F	-	RF	-	-	-	-
3	Gullbilled Tern	F	-	RF	-	-	-	-
7	Shikra	-	-	-	-	-	F	RF
14	Blue Rock Pigeon	-	-	RF	-	F	F	-

Table No. 6 (contd.)

MULA-MUTHA RIVER BIRD SANCTUARY (PROPOSED)

CLASSIFICATION OF BIRDS ACCORDING TO HABITAT-USE -

Life Form	Name of Bird	NATURE OF HABITAT						
		Open Water	Water edges	Rocks Midstream	Back-Waters	Meadows	Scrub land	Woodland
6	Little Brown Dove	-	-	RF	-	-	F	RF
6	Koel	-	-	-	-	-	-	F
7	Crow-pheasant	-	-	-	-	-	F	F
6	Hawk-cuckoo	-	-	-	-	-	-	F
11	Coppersmith	-	-	-	-	-	-	F
7	Plaintive Cuckoo	-	-	-	-	-	-	F
12	Spotted Owlet	-	-	-	-	-	-	F
14	House Swift	F	-	F	-	F	F	-
14	Hoopoe	-	-	-	-	F	F	RF
6	Indian Roller	-	-	-	-	-	F	F
3	Blackwinged Stilt	F	F	RF	F	-	-	-
9	Small Green Bee-eater	-	-	-	-	-	F	F
9	Pied Kingfisher	F	RF	R	-	-	-	-
9	Small Blue Kingfisher	F	RF	RF	F	F	-	-
9	White-breasted Kingfisher	-	RF	RF	F	F	F	R
11	Grey Hornbill	-	-	-	-	-	-	F
6	Wryneck	-	-	-	-	-	-	F

Table No. 6 (contd.)

MULA-MUTHA RIVER BIRD SANCTUARY (PROPOSED)

CLASSIFICATION OF BIRDS ACCORDING TO HABITAT-USE

Life Form	Name of Bird	NATURE OF HABITAT						
		Open Water	Water edges	Rocks Midstream	Back-Waters	Meadows	Scrub land	Woodland
4	Yellow Wagtail	-	-	F	F	F	F	-
5	Indian Pipit	-	-	-	-	F	F	-
9	Redrumped Swallow	F	-	-	F	-	F	-
9	Wiretailed Swallow	F	F	F	-	-	-	-
9	Common Swallow	F	F	F	-	F	F	-
6	Baybacked Shrike	-	-	-	-	-	-	F
6	Rufousbacked Shrike	-	-	-	-	-	F	F
7	King Crow	-	-	-	-	F	F	RF
7	Golden Oriole	-	-	-	-	-	-	F
12	Common Myna	-	F	F	-	F	F	F
12	Brahminy Myna	-	-	F	-	-	F	RF
7	Jungle Crow	-	F	F	-	F	F	RF
7	House Crow	-	F	F	-	-	F	F
12	Grey Tit	-	-	-	-	-	-	F
6	Redvented Bulbul	-	-	F	-	-	RF	F
12	Jungle Myna	-	-	F	-	F	F	-
6	Large Grey Babbler	-	-	-	-	-	F	F
4	Bluethroat	-	F	-	F	F	-	-
5	Streaked Fantail Warbler	-	-	-	-	F	RF	-

Table No. 6 (contd.)

MULA-MUTHA RIVER BIRD SANCTUARY (PROPOSED)

CLASSIFICATION OF BIRDS ACCORDING TO HABITAT-USE

Life Form	Name of Bird	NATURE OF HABITAT						
		Open Water	Water edges	Rocks Midstream	Back-waters	Meadows	Scrub land	Woodland
5	Indian Wren Warbler	-	-	-	-	F	RF	-
6	Ashy Wren Warbler	-	-	-	-	-	RF	F
6	TailorBird	-	-	-	-	-	-	RF
5	Indian Robin	-	-	-	F	-	RF	F
10	Blue Rock Thrush	-	-	-	F	-	F	-
5	Stonechat	-	-	-	-	-	F	-
4	Yellowheaded Wagtail	-	F	F	F	F	-	-
5	White Wagtail	-	-	-	F	F	F	-
9	Large Pied Wagtail	-	F	F	-	-	-	-
5	Rufous-tailed Finch-lark	-	-	-	F	-	F	-
6	Weaver Bird	-	-	-	F	F	F	-
6	White-throated Munia	-	-	-	-	F	F	-
5	Blackheaded Munia	-	F	-	-	F	-	-
5	Red Munia	-	-	-	-	F	F	-
14	House Sparrow	-	F	F	-	-	F	F

Table No. 1

CLASSIFICATION OF BIRDS ACCORDING TO LIFE FORM, SEASONAL OCCURRENCE, REPRODUCTIVE CAPACITY & HOME RANGE

Letter Code	Life Form	Name of Bird	Scientific Name	Seasonal Occurrence (Months of Year)												Reproductive capacity	Home Range
				1	2	3	4	5	6	7	8	9	10	11	12		
PHNI	7	Little Cormorant	Phalacrocorax niger														

Table No. 2

CLASSIFICATION OF BIRDS ACCORDING TO HABITAT-TYPES AND/OR PLANT COMMUNITIES

Life Form	Name of Bird	Minimum Habitat Required for individual, Pair, colony or population	Habitat-types/Plant Communities						Special Habitats					Unique Habitats				
			1	2	3	4	5	etc.	1	2	3	4	etc.	1	2	3	4	etc.

Table No. 3

WILDLIFE ORIENTATION TO PLANT COMMUNITIES BY LIFE FORM

R = Reproduction F = Feeding

Code	Life Form	Name of Bird	Plant Communities						Total R	Total F
			1	2	3	4	5	6		
	1									
		Total No. of Species for R								
		Total No. of Species for F								

(Each Life Form will have its own table for the species covered by it.)

Table No. 4

WILDLIFE ORIENTATION TO SUCCESSIONAL STAGES BY LIFE FORM

Code	Life Form	Name of Bird	Successional Stages												TR	TF
			Grass-Forb		Shrub-Seedling		Pole-Sapling		Young Trees		Mature Trees		Old Trees			
			R	F	R	F	R	F	R	F	R	F	R	F		
		1														
		2														
		3														
		4														
		5														
Total No. of Species for		R														
		F														

TR = Total Reproduction TF = Total Feeding

(Each life Form will have its own table for the species covered by it)

Table No. 5

RELATIVE DEGREE OF USE BY THE LIFE FORM OF INDICATED PLANT COMMUNITIES & SUCCESSIONAL STAGES

Plant Community	Function	Successional Stage					
		1	2	3	4	5	6
1	R						
	F						
2	R						
	F						
3	R						
	F						
4	R						
	F						

R = Reproduction F = Feeding

(There will be one table for species from each Life Form)

A FIELD GUIDE TO CRANES
OF
THE INDIAN SUB-CONTINENT

By
Prakash Gole

E C O L O G I C A L S O C I E T Y, 1 9 8 6

I CRANES IN GENERAL

Cranes are birds with long legs and long necks and not so long beaks. In colour they are shades of black and white; from pure white (Siberian Crane) to dark grey (Demoiselle Crane). In height they vary from less than a meter to almost 1.5 meters(from 3.5 to 5.0 feet). Generally cranes are found in pairs or in flocks whose contents may vary from 7-10 to many thousands.
There are 14 species of Crane found in the world. The following of the 14 are found in the Indian sub-continent :

1. Sarus (Grus antigone)
2. Blacknecked (Grus nigricollis)
3. Eurasian (Grus grus)
4. Hooded (Grus monachus)
5. Demoiselle (Anthropoides virgo)
6. Siberian(Gurs or Bugeranus leucogeranus)

Cranes are mainly confined to the northern parts of the sub-continent. They become rarer as one travels south and east in the sub-continent. In Pakistan they are seen on passage as they travel to and fro to their wintering grounds in India. In India they are numerous in the states of Gujarat, Rajasthan, Uttar Pradesh, and Bihar. From this region, their stronghold, they spill over into areas in adjacent states : Punjab, Haryana, Madhya Pradesh, Maharashtra, West Bengal and some areas in Nepal and Bangladesh. A few go as far as the valleys of Himachal Pradesh, Jammu & Kashmir and the valley of the Brahmaputra in Assam.

In the rest of the sub-continent they are rare or uncommon. They are not found in Sri Lanka. Bhutan,

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as we shall see later, presents a rather special case.

II ENDANGERED CRANES

Of the six species of Crane found in the sub-continent three are considered to be endangered. They are : Blacknecked, Siberian and Hooded. The Hooded is however, a strangler to the eastern part of the sub-continent and is not a regular winter visitor. A sub-species of Sarus, the Burmese Sarus(Grus antigone sharpii), used to be found in the eastern parts. Its present status in this part of the sub-continent remains obscure.

The blackneck breeds regularly in Ladakh but in very small numbers. Every year 3 to 5 pairs arrive in April-May into Ladakh and migrate to warmer lands in October after finishing nesting and together with their offsprings as the marshes in Ladakh begin to freeze with the onset of winter. There are two known wintering areas of Blacknecked Crane in the sub-continent. Till the seventies they used to winter in the Apa Tani valley of the Subansiri Division in Arunachal Pradesh In India. They are not sighted in this valley in recent years. The other wintering areas lie in Bhutan where since 1978 they have been sighted regularly in Boomthang and Popshika valleys in central Bhutan. There the flocks contain from 13-15 to 60-65 Blacknecks.

The Siberian Crane is a regular winter visitor to the Keoladeo Ghana National Park in Rajasthan. But the wintering population has declined from 70-76 in the seventies to 35-41 in 1984-85. They are not known to winter anywhere else in the sub-continent and a close watch is kept on the small group that winters in the

Ghana

Siberian and Blackneck Granes are fully protected by law wherever they occur. For example, they are included in Schedule I of India's Wildlife Protection Act. They are not to be killed or molested under any circumstances and any harm done to them will attract heavy fine and imprisonment.

Let us now see how to identify these endangered cranes in the field.

Blacknecked Crane

This very rare crane is regularly found only in Ladakh during May to October and in Bhutan from November - December to March. However, all its nesting sites within Ladakh fall in the restricted zone where for security reasons not everyone is permitted to enter. Unless you are in the Armed Forces of India or in the service of Jammu and Kashmir Government, or carry a special permit from Government of India or you are a resident of Ladakh, it is not likely that you will see this crane. In recent years a few scientists and others on government duty have been allowed to enter the restricted zone. In Bhutan also persons carrying a special permit from the Royal Government of Bhutan are only allowed to enter the wintering areas of the Blacknecked crane.

Within the restricted zone in Ladakh this crane is found usually near two villages; Chushul and Hanle. There are large fresh water marshes in the vicinity of these villages where these cranes arrive in pairs for nesting and/or foraging . Every year they arrive in May and will leave these areas in October for their wintering grounds(which may lie in south Tibet or

Bhutan). As winter sets in marshes begin to freeze in Ladakh and food becomes scarce for the cranes.

Now if you happen to be in Ladakh during their breeding season, you may have to go to these villages to see the cranes. Their nesting marshes are pretty well-known to local people and you will have little difficulty in recognising these white birds with jet-black necks. The black feathers over the tail are also distinctive. However, in that environment of vast, open, sandy plains bereft of trees, the cranes are not conspicuous and it may take an effort to locate them.

This crane is just over a meter tall (about four feet in height), with long, brownish-black legs. One of the pair may be incubating eggs on the nest built in shallow water. The nest is a large platform of aquatic vegetation pulled from the surrounding marsh and on which two eggs are laid. The male and female alternately incubate these eggs. While one incubates the other may be standing or feeding nearby in the marsh.

It is advisable not to be very near but to observe the cranes from a distance of 200 to 300 meters. They should not be disturbed while nesting. However, if you wear the local Ladakhi costume, the cranes will not be disturbed even if you watch from a distance of about 100 meters.

Outside Chushul and Hanle the cranes can be seen in the Tso Kar & the Tso Moriri basins. These two are remote brackish lakes surrounded by sand & soda & are unlikely to be visited in the normal course of the journey. Cranes can also be met elsewhere in the restricted zone especially along the Indus river before it meets the river Hanle or on the shores of the lake Pangong in late April or early May when they are on the way to the

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breeding marshes.

Likewise later in the season, when the chicks begin to grow up, the cranes widen their foraging area and roam extensively over the marshes and in the surrounding sands. They may then be found away from their breeding marshes, pairs accompanied by juveniles, or still later in the season, even two or more pairs together. In Boomthang and Popshika valleys in Bhutan in winter, cranes are normally seen in flocks which forage in harvested fields near villages and roost at night near a stream. Sometimes a pair with a juvenile may be seen away from the Blackneck flock. In severe winters a stray Blacknecked Crane has also appeared in the Katmandu valley of Nepal.

SIBERIAN CRANE

Probably you will not see this crane except in the K. Ghana National Park near Bharatpur, Rajasthan in India. There you will find these cranes standing in a marshy place in shallow water. From a distance the Siberian will look like a gigantic egret. But you will immediately notice the stouter red or pink-coloured beak, longer pink coloured legs and a walking gait that is different from an egret's. You will also notice the different head-pattern, as if the bird lacks a true head or face & the beak is just thrust into his face. This is because the area of the face is almost bare of feathers & is brick red, the colour of the bird's beak. If the bird opens its wings to flap or to take-off, you will see its black primaries. They are evident once the bird is air-borne, but remain concealed when the bird is standing. This crane has a peculiar mono-syllabic, high-pitched call. When it calls it opens its wings, its black primaries are stretched along its flanks and the crane

Vigorously moves its head up and down.

Siberian Cranes will be seen as a family group or a small flock. Male and female, when adult, look pure white and it is difficult to distinguish them in the field. But if it is a family group, you will immediately notice the difference between juveniles and adults. Juveniles have buff or cinamon feathers on head, neck, back, wings etc. The face is also buff or cinamon and not brickred. Normally a family group will consist of the pair and one or two chicks(juveniles).

The only bird with which this crane can be confused is the White Stork(Ciconia ciconia).. The crane however, is taller than the Stork and will appear pure white when standing. The White Stork when standing, always shows its black primaries and black feathers over the tail. Its face is white and not brick-red and is also not bare of feathers. In flight it is more difficult to distinguish these two birds.Only the large size will indicate that it is the crane. Also storks in winter are seen as solitary birds while cranes are always in pairs, family parties or small flocks. The group of Siberian Cranes that winters in K.G. National Park near Bharatpur, travels through Iran and Afganistan before it enters the sub-continent. The route that they follow after leaving Afganistan is not known. They have not been sighted on any wetland between Afganistan and Bharatpur. They probably travel at night. But whether they fly non-stop from Afganistan to Bharatpur is any-body's guess. It will be interesting to look out for them on large, shallow wetlands abounding in aquatic vegetation. They arrive in the Ghana from late November to early January. Early December appears to be the most promising period to look for them. Once in the Ghana the Siberians show a tendency to spend at least a part of the day

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outside the National Park. It is not known where they go. It is necessary to find these places and to protect them so that the cranes do not come to grief once they leave the boundaries of the National Park.

III CRANES NOT YET ENDANGERED

Sarus, Eurasian and Demoiselle cranes are not yet endangered in the sub-continent, though at least in some parts they face persecution and habitat destruction, Local sentiments more or less protect the Sarus though permits can be obtained to hunt the other two. In some parts of Pakistan decoy cranes are used wild flocks in snares and traps.

Sarus Crane

This is the well-known resident crane of India. There are references to this crane in Indian epics, Sanskrit plays and poetic works. In later times Moghul chronicles also describe the habits and rearing of Sarus cranes. Traditionally the Sarus pair is considered a symbol of perfect conjual love and is not persecuted. The birds then become a part of the vallage milieu and are not afraid of villagers.

The Sarus is no longer found in the Indian peninsula proper; neither is it found in Sri Lanka. The southern limit of its distribution in Bhandara and Chandrapur districts of Maharashtra. Practically the whole of India north of this region is the home of Sarus. It is however, not found in the more arid, or desert like parts of Rajasthan and further west in Pakistan and only makes an occasional appearance in the 'Kashmir Valley' and other valleys of the lower Himalayas(such as Kulu) in India and Nepal. In Assam and regions further east, a sub-species of the Sarus (Grus Antigone Sharpii) used to be found. But in recent times it has become very rare in these parts. It is now considered endangered and is protected.

Sarus pairs are now found near water, in cultivated and harvested fields, in marshy and water-logged areas and generally not far from human habitation. Pairs or small flocks are normally encountered. However, outside the breeding season (August to February) large flocks running into a few hundreds can also be seen in certain places.

Sarus is our tallest flying bird and makes itself conspicuous wherever it appears. He is over-all grey with a bare grey patch on the head and face. Its upper neck is also bare of feathers but is red in colour and covered with course granulations. The lower neck is covered with white feathers, the extent of white appearing to be greater in females than in males. The legs and toes are red or pink but may also appear brownish pink if stained by mud. The bill is greenish-grey. The Burmese or Eastern Sarus is over-all grey. It also lacks the white neck-feathers as characteristic of Indian sarus. The former is also slimmer than the latter.

Male and female Sarus look alike but the latter may be a little shorter. While unison-calling the male spreads its wings, stretches its neck skywards and gives out a resounding call while the female merely stretches her neck skywards and utters a short mono-syllabic call. After the nesting season pairs are seen with one or two juveniles that are pale grey and show brown and cinnamon-brown feathers on their upper parts. The bare red area on the face and the neck is also undeveloped. The pair builds its nest on the ground in marshy or shallow-water areas. Sometimes the nest is built in a

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flooded paddy field inviting the wrath of the cultivator. Two greenish-white eggs spotted with brown or purple are laid and incubation is shared by both the sexes.

Eurasian Crane

This crane, also called Common Crane, arrives in the sub-continent in winter from parts of Europe, Central Asia and China where it breeds. They start arriving in October from north-west and north-east and are seen on passage in Pakistan and Nepal from September. Those entering from north-west spend sometime in Rajasthan before reaching their wintering grounds in Gujrat and Central India. Once in India they are confined to the west, north and west-central parts and become progressively scarcer towards east and south. They can commonly be observed in winter in Punjab, Haryana, West Uttar Pradesh, Gujarat and parts of Madhya Pradesh. Orrisa, West Bengal, northern Andhra and north Maharashtra(Nasik District) also get a few numbers which probably overfly the Himalayas. Very few penetrate the peninsula. The return migration takes place in March.

In appearance this crane is overall grey with rather prominent brownish dark-grey feathers over the tail. These arch and droop over the tail. Primaries are also black and look dark. Legs are black while the beak is horny. However, from a distance what strikes the observer is the white stripe, which starting from behind the eyes, runs down the back of the neck to the shoulders. A dull red, naked patch on the nape will also be evident.

In winter these cranes are found in flocks which number from less than a score birds to few thousands. In large flocks a number of juvenile birds can be readily distinguished by their overall rufous-brown appearance. The head and neck of the juveniles are also rusty-brown.

These cranes are found in freshly-ploughed and cultivated fields, along the banks of the reservoirs, in open grasslands and at the edges of the marshes. They forage in the morning in cultivated and harvested fields and spend the warmer part of the day in a favourite spot which may be a secluded field, or a beach of a reservoir or an upland and open scrubland away from villages. In Gujarat where they are not hunted, the flocks can often be found near villages. At night they roost on islands within reservoirs or on their banks near water. Flocks of Eurasian and Demoiselle cranes are often found close to each other.

Demoiselle Crane

Eurasian and Demoiselle cranes probably arrive at the same time in the sub-continent. This crane arrives over a broad front from north-west to east, over-flying the Himalayas at many places including the Nepal Himalayas. On passage they are seen in Pakistan and Nepal. In late September or October the flocks arrive in Rajasthan but do not linger there long. They travel to Gujarat, Maharashtra and even penetrate further south into the peninsula of India. Birds coming through Nepal probably spread over east U.P., Bihar, Orrisa, West Bengal but become scarce further east and south. However, they are most numerous in Gujarat where a count of over a million has been reported.

In appearance Demoiselle Crane is smaller than the Eurasian Crane and is also darker grey in colour. Indeed from a distance this crane looks a lovely bluish grey bird.

What strikes the observer is their black foreneck contrasting with the bluish body, the dangling black feathers of the lower neck falling over the breast and drooping blackish-grey feathers over the tail. On closer examination a white plume behind the eyes, often fluttering in the wind, can also be noticed. This crane lacks the red bare patch on the head as characteristic of other cranes. In winter they are found in cultivated and harvested fields, on the margins of lakes and reservoirs and on islands and sand-bars in lakes and rivers. They are reported to do some damage to standing crops of pulses. They roost at night on lake margins and on islandsand sand-bars within lakes.

From their roost they fan out early in the morning for feeding in harvested fields. They feed from early morning to mid-morning and then in the fore-noon different flocks start converging on a favourite spot for their noon siesta. This spot is often a sandy beach of a reservoir or an island where thousands congregate. There they stand in row after row, a mass of blue-grey feathers, shimmering in the heat. If someone approaches, a great cacophony bursts out from the mass and outermost lines start taking wing. Otherwise the cranes just stand there motionless for hours till some are compelled by pangs of hunger to go out again towards evening in search of food. In some areas in Gujarat, villagers Protect the cranes & in such places the cranes do not show much concern even if a bullock-cart ploughs through the blue-grey mass.

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THE STATUS OF RSFSR RED DATA BOOK BIRDS IN INDIA

Pelecanus onocrotalus

Resident and also winter visitor to north India; probably also on the east coast. Congregates on large lakes and reservoirs, sometimes as many as 500-600 birds. Breeds in the Great Rann of Kutch. Breeding first discovered in 1960. Breeding area now a protected sanctuary. Some states have banned hunting and trapping of all Pelican species. A partial all-India count gave the following numbers: 1987: 2330; 1988: 5940; 1989:5453.

Pelecanus crispus

Winter visitor to north India; recorded in the states of Punjab, Haryana, Rajasthan, U P, West Bengal and Gujerath. Seen on large rivers, lakes, and lagoons in small flocks. Numbers counted 1987: 49, 1988:60, 1989:55. Protected in some states. No ringing data.

Phalacrocorax pygmaeus

Not recorded in recent years. Only one specimen collected in 1917 in an area(Baluchistan) which is now in Pakistan. Might have been overlooked as identification in the field difficult and confused with P. niger.

Bubulcus ibis

Common and abundant everywhere in India. Migrates to lower elevations in winter in the Himalayan regions. Breeds and roosts on large trees in villages and cities. Breeds throughout the year in different parts of the country in small breeding colonies. Attends roaming cattle and wild herbivores, riding often on their backs and running in and out of their legs. Large numbers attend ploughing of fields. No.s counted: 1987:4002, 1988: 7526, 1989: 13830 (the count probably reflects less than 10 p.c. of the total numbers.). Not legally protected in the country.

Egretta intermedia

Common and numerous everywhere in India. Breeds colonially in trees or mangroves mainly during the rainy season; found singly or in small flocks along rivers, marshes, lakes, reservoirs etc. No.s counted: 1987: 706, 1988: 2625, 1989: 7807. Not legally protected in the country.

Platalea leucorodia

Resident and also winter visitor. Found all over India on rivers, lakes, reservoirs and marshes; sometimes also on the sea coast. 4 Spoonbills ringed in the Caspian region of USSR recovered in winter in north India, one even in July. Resident birds nest July to October in north India and November to January in south India. Main breeding grounds Keoladeo Ghana National Park in Rajasthan, north India and Vedanthangal and Ranganthitoo sanctuaries in south India. Protected legally throughout the country. No.s counted: 1987:2365, 1988:1765, 1989: 5017.

Plegadis falcinellus

Resident and winter visitor. Found all over India near rivers, lakes, marshes and reservoirs. Breeds colonially in trees near water. Recovery of 2 birds in north India ringed in the Volga delta of USSR. Not legally protected. No.s counted: 1987:448, 1988: 278, and 1989: 1991.

Ciconia boyciana

Uncommon winter visitor to Assam and Manipur. But no recent records. Legally not protected.

Ciconia nigra

Winter visiotr to north India as far south as near Pune. No ringing data but spring passage recorded through Kashmir and Ladakh and autumn and spring passage through Gilgit in Pakistan. Keeps in the neighbourhood of rivers, marshes, reservoirs, ponds and pools in forest etc. singly, in pairs or in small groups. Associates with Ciconia episcopus. Legally not protected. No.s counted: 1987:8, 1988: 1 and 1989: 114.

Anser erythropus

Rare winter visitor to north India. 2 or 3 sometimes observed in Anser anser flocks. No ringing data. Legally not protected.

Anser indicus
(Eulabeia indica)

Resident and also winter visitor. Breeds in Ladakh on barren islands in lakes Tso moriri and Pangong tso. Formerly also used to breed in cliffs. Biggest breeding colony in India on the Tso moriri discovered in 1980. About 100 pairs breeding there from late April; the breeding location situated at an altitude of 4200 meters. On migration observed in northwest Pakistan and Kashmir on autumn passage and through Nepal over a broad west-east front in Karnali and other river valleys on spring passage. Mountaineering expeditions have observed them crossing over some of the highest Himalayan peaks. 2 birds ringed during the breeding season in the Kirgiz SSR were recovered in subsequent winters in Gilgit in Pakistan.

During winter more common on lakes and rivers in Rajasthan, U P and along the Brahmaputra in Assam. Some birds go as far south as Maharashtra and Karnataka. When there is drought in the north the geese tend to concentrate on suitable well-watered lakes and reservoirs in the south. Also found on large lagoons such as the Chilka and Pulicat on the east coast. Not yet legally protected in India though the low world population is causing concern and proposals are before the Government to accord full protection. Breeding areas in Ladakh are protected. No.s counted: 1987: 3545, 1988: 3306, 1989: 5787.

Marmaronetta angustirostris
(Anas angustirostris)

Rare winter visitor to north India upto Gujerath and Maharashtra in the south. Breeds in Baluchistan and Sind in Pakistan. In winter numbers augmented due to migrants from the north. No ringing data. Affects reedy and vegetation rich lakes. No.s counted: 1987: 0, 1988: 339 and 1989: 14. Not legally protected.

Aythya baeri

Rare winter visitor to east India such as Assam and Manipur. Sometimes recorded in Bihar. Affects large rivers and lakes. No ringing data. No.s counted: 1987: 1, 1988: 0, 1989: 3188(?).

Oxyura leucocephala

Rare winter visitor to northwest India straggling as far south as Gujerath. More common in Pakistan. Affects large lakes and lagoons.Recently a few were ringed on the Harike lake in Punjab but no recovery data.

Pandion haliaetus

Breeds in small numbers along the Himalayas between 2000 & 3300 meters and also in Ladakh and Assam. In winter found throughout the country on large lakes, rivers, reservoirs, marshes and also on the sea coast, lagoons etc. Legally protected throughout the country. No count attempted so far.

Accipiter soloensis

Winter visitor to Nicobar islands. Not legally protected. No count attempted so far.

Buteo rufinus

Resident and winter visitor. Breeds in Ladakh in cliffs. In winter found in north India and in smaller numbers in the south upto Maharashtra. Affects hilly country, rivers and marshes, cultivation, light forest and semi-desert areas. Not legally protected. No count attempted.

Circaetus gallicus

Found throughout the country but nowhere common. Affects stony, foothills country, also cultivated plains and scrub in arid and semi-arid areas. Sometimes seen around hill resorts in the Himalayas and in the south at moderate elevations. Nests in moderately high trees in open country. Not legally protected. No count attempted.

Spizaetus nipalensis

Resident in the Himalaya between 600 and 2400 meters altitude from Kashmir to Arunachal; also north and south of the Brahmaputra and in Manipur. In winter descends and spreads over the plains of north India as far south as Madhya Pradesh. Not legally protected and no count attempted.

Aquila rapax

Resident and winter visitor(A. r. nipalensis). Found throughout the country and breeds in large trees often near villages. A pirate of other birds of prey. Often gathers around garbage dumps. A gathering of 200 around a chicken-waste dump recorded near Pune in 1973. Migration route recorded through South Col of Everest at height of 8000 meters where dead eagles were found twice by mountaineers. Not legally protected. No count attempted.

Aquila heliaca

Winter visitor to arid and semi-arid regions in small numbers. North-east to South-west migration observed in Himachal Pradesh in November. Carrion eater and robs other birds of prey of their food. Not legally protected; no count attempted.

Aquila chrysaetos

A resident of the Himalaya and Ladakh between 3000 and 5500 meters. Rarely comes below these altitudes. Not uncommon above the tree line. Nests in large conifers and in trees. Not legally protected and but some of its breeding regions are protected as sanctuaries; no count so far.

Haliaeetus leucoryphus

Resident and also migratory. Found all over north India south to Orissa. Affects large lakes, reservoirs, rivers, marshes and sea coasts. Breeds in the plains of north India in winter in large trees near water and in summer in the Himalaya and Ladakh. Very vocal during the breeding season. Not legally protected but some of its breeding areas such as Keoladeo National Park, Rajasthan and Kaziranga National Park, Assam, are protected.

Haliaeetus albicilla

Occasionally recorded in winter from Himachal Pradesh, Kutch and Rajasthan. Travels in from the coast up large rivers and lakes. Not legally protected. No count.

Gypaetus barbatus

Gypaetus barbatus

A resident of Himalayas, Ladakh between 1200 and 4000 meters. Rarely comes lower but recorded in Cachar hills in Assam. Common over its range. Breeds in inaccessible cliffs. Legally protected in India.

Neophron percnopterus

Common resident found throughout the country near villages and cultivation. An altitudinal migrant. Nests in cliffs, on lofty temple spires, mosques, ancient forts. Not legally protected.

Aegypius monachus

Resident in Ladakh and Lahul in Himachal Pradesh, possibly all along the Himalaya between 1800 & 3600 meters and also in north Cachar hills in Assam. Rare winter visitor to north and central India south to Maharashtra. More commonly seen in Assam. Nests on a high tree jutting out of a cliff. Legally not protected. No count.

Gyps fulvus

Common in arid and semi-arid regions of north India. A few may stray east to Assam and south to Maharashtra. Breeds in Kashmir and in Pakistan in cliffs. Not legally protected. No count.

Falco peregrinus

Winter visitor throughout the country but nowhere common. Affects rivers, marshes, lakes, coastal lagoons where migratory waterfowl congregate. Hunts singly; active early morning and late evening. Legally not protected. No count.

Grus leucogeranus

In recent years regular winter visitor to Keoladeo Ghana National Park, Rajasthan, about 167 km south of New Delhi though numbers have declined from about 100 in 1960 to 17 in 1989. Formerly recorded in small numbers over a wide area from Ladakh and Kashmir to east UP and north Maharashtra. Since 1984-85 has developed the habit of going outside the national park to feed as suitable habitat in the park has shrunk due to shortage of water. In 1989 a few were sighted on a wetland near Agra and a pair on one of the arms of Baretha reservoir about 50 kms southwest of the national park. Aerial surveys have been conducted to find out the wetlands where these cranes migrate from the national park. During the winter of 1989 out of 17 that arrived in the park, 8 stayed outside the park and only 9 were usually seen in winter in the park. Legally protected in India.

Cooperative research and monitoring programmes will be undertaken by Indian and Soviet scientists in near future to find the migration route of the flock. Satellite tracking and captive breeding and release are some of the techniques that will be employed by the scientists.

Grus monacha

In the past recorded in small numbers from Assam, Manipur etc. But no recent records of occurrence.

Anthropoides virgo

Common winter visitor recorded from suitable habitats throughout the country except deep south and east. More common on lakes and reservoirs in arid and semi-arid regions of Gujerath, Haryana, MP, Maharashtra and Andhra Pradesh. A few go as far as Karnataka in the south and Assam in the east. Huge flocks converge to roost on the banks of large lakes and reservoirs. 5000 to 10,000 strong flocks have been recorded from reservoirs in the Saurashtra peninsula in the west. From the roost sites they take off early in the morning to nearby harvested fields where they glean fallen grain and groundnut. They come back to the roost site around 11 a.m. and spend the noon standing at the edge of the reservoir. In the evening some from the flock again go out to feed in the fields and return in the late evening to roost. Legally not protected. No.s counted: 1987: 17064, 1988: 43313, 1989: 37070.

Porzana fusca

Common resident found throughout the country in marshes, flooded fields, reedbeds along lakes and reservoirs. Shy, difficult to see and therefore, has not been counted in waterfowl counts. Legally not protected.

Porphyrio porphyrio

Common and abundant resident found throughout the country on reed and vegetation covered lakes, reservoirs, marshes, flooded ricefields. Large gatherings of a few hundred can be seen in suitable habitats. Nests in reeds and other dense vegetation along lakes and marshes. Nos counted: 1987:1400, 1988: 1812, 1989: 3306.

Otis tetrax

Winter visitor in small numbers to northwest India. Legally not protected. No count attempted.

Chlamydotis undulata

Winter visitor to Rajasthan, Kutch and Saurashtra peninsula. Used to be favourite hunting for parties of wealthy Arab Sheikhs who used to camp in those parts of India and hunt Houbaras with falcons. Public outcry against this hunting led to legal protection of this bird. No count is yet attempted.

Burhinus oedicnemus

Common resident of stony, arid and semi-arid regions. Found throughout the country. Not legally protected.

Charadrius leschenaultii

Winter visitor to west and east sea coasts. Arrives August-September, departs April-May. Some individuals in non-breeding plumage remain throughout the year. No ringing data. No.s counted 1987: 32, 1988: 70, 1989: 110. Legally not protected.

Himantopus himantopus

Resident and winter visitor. Breeds throughout the country except deep south between April and August on dry lake beds or salt pans. Also a scavenger along polluted rivers, streams and other water courses. In winter numbers augmented by migrants from the north. Legally not protected. No.s counted 1987: 7825, 1988: 19258, 1989: 27282.

Recurvirostra avosetta

Resident and winter visitor. Breeding in Kutch was first discovered in 1945 when over 1000 birds and 150 nests were counted. In winter numbers augmented by migrants. Found in brackish and salt lakes, salt pans and on sea coasts; also in such lakes and reservoirs in cities and around villages. Not legally protected. No ringing data. No.s counted: 1987: 240, 1988: 2968, 1989: 2480.

Euryrhynchus pygmeus

Very rare winter visitor to the east coast of India. One or two recorded in recent years. Not legally protected.

Limnodramus semipalmatus

Rare winter visitor to the east coast of India. Legally not protected.

Glareola maldivarum

Resident and summer visitor to various parts of the country. Breeding recorded from MP, West Bengal and Assam. Affects dried-up flood plains by large rivers, tidal mudflats and marshes, paddy stubbles in coastal areas, ploughed and fallow fields and open grazing grounds. Legally not protected. No.s counted 1987: 6, 1988: 6, 1989: 24.

Larus ichthyaetus

Winter visitor to both the coasts of India. Sometimes also recorded inland on large lakes, reservoirs and marshes. Legally not protected. No.s counted: 1987: 10, 1988: 73, 1989: 193.

Ninox scutulata

Resident and found throughout the country in different races. Very little observed and studied. Legally not protected. Numbers not known.

Terpsiphone paradisi

Resident and locally migratory; found throughout the country in different races. The northern race breeds in Kashmir, Punjab, UP,Himachal Pradesh and winters in the peninsula. The southern race breeds in the hills of the peninsula and winters in Sri Lanka where also a race is present. The Himalayan birds migrate to plains of northern India in winter. Common but very unevenly distributed. Not legally protected. Numbers not known.

Saxicola insignis

Rare winter visitor to UP, Bihar, northern Bengal and Sikkim. Arrives in October and leaves in late March, early April. No ringing data. Legally not protected.

Passer rutilans

Common resident and altitudinal migrant of the Himalaya. Breeds between 1200 and 2700 meters and winters down to 500 meters and in adjacent plains of the Himalaya. Not legally protected. No ringing data.

Prakash Gole

Summary of the Article.

In future it may be increasingly difficult to find large areas fit to be declared as Sanctuaries for animals & birds. Many of such areas are already protected & many other are succumbing to economic & population pressures.

On the other hand the demand for creation of sanctuaries is likely to increase as more & more people become convinced of the importance of nature conservation.

The trend is set by the All-Maharashtra Bird-Watchers' Meet. They campaigned for 3 places to be declared as bird sanctuaries & these proposals are now accepted by the Govt. Thus in future all over the country many sites, including sites made by man such as reservoirs & planted forests, will come to be protected & eventually declared as sanctuaries. How to manage the flora & fauna of these often small & compact places will be a problem that is going to be faced by all concerned.

My paper is an attempt to provide a frame-work on which future management practices can be built up. It tells the manager what data are relevant & pertinent for decision-making & how to organise them so as to facilitate making of decisions. The manager himself may be too busy to collect all the relevant data. He has to be backed by competent ornithologists. Indeed their services are indispensable for the management of bird sanctuaries.

At last we have found a definite niche for the poor ornithologist. I hope this will help him survive!

Now what are the basic data:

1. List of birds with their occurrence through the seasons, their status — common, rare, vagrant, target-breeding, wintering etc. Resident/migrant birds
2. Pattern of available habitats — land-use, dominant plant-communities, their successional stages, type of special habitats & unique habitats.
3. Use of several habitats by birds
   : for feeding & reproduction
   : food for birds & how to make it available
   : How to make breeding habitats safe
   : for Resting, loafing & roosting
   : Size of Home Range & Territory
   : Reproductive capacity — crowding
   : Minimum habitat required per unit — pair, population, colony etc.

Use of plant communities & their successional stages by birds
Versatility Rating
Now how to organise these data :
Table 1 : Classification of birds on the basis of habitat-use. That is what is relevant.
Based on the system developed by U.S. Forest Service
Adapted to our conditions.
Life - forms. —— The subsequent tables ~~are~~ based on life forms.
The format - Tables are explained.
This seems to be near-ideal situation
But all these data are not available at present in our country.
Therefore, the examples I present here, consider data that are available.
These 2 case-studies are presented as I am familiar with both of them:
They are : 1) Proposed Woodland or forest birds Sanctuary
2) Proposed wetland or water-bird sanctuary

Notification for Tadoba
Final yet to come.
Yaval, Radhanagari, Karnala,
Tansa — } To be
Karnala } extended
Nagzira, Bor, Kinwat (ext.)
Rehekuri — Problem
Tranquilising not successful
Great Ind. Bustard – may ex. forest
or village. Plantation drive today
Bustards.
Melghat – 80 tigers
Gautala – 260 Km.s sq.
Kalsubai, Bhimashankar
Phansad, Sagareshwar
Game Reserve – Closure
Mayani – Game reserve
64,000 sq. Km-s. forest
4.4 % of total area protected
will go upto 4.8 %.
Jayakwadi – Plantation along
canals.
Sanctuary – no threat to rights
of peoples except shooting of
animals.

Prawn breeding centre
Sweet water prawns - research exists. Tapi, Narmada
Mangroves now protected.
Wasteland - fodder
Chemicals that increase fodder
Fodder growing in rooms
Cellulose converted into protein by bacteria.

Recommendations

1. CADA - ecologist to be represented.
2. Least interference before dam is left.
3. CADA - ~~ecologist~~ for every project - ecologist to be represented.
4. No vehicles on Panshet Road
5. S. Command rules to be applied everywhere & military stations
6. Lay down norms for diff. cantonments
7. Leases to be resumed for public purposes
8. Immediate listing & protection of heritage buildings for all Canton...
9. Cantonment Market - 100 years old
10. Laws intended for improving quality of life to be enforced. Propaganda on media.
11. Regional Planning authority for Pune like BMRDA.
12 Disincentives for growth.

13. Prone Comtt. bye-laws should not be revised upwards

14. Western Ghats Wildlife Sanctuary

16.

17.

1. It is recommended that Govt. of Maha. should constitute a Catchment Area Development Authority for all the catchments of dams in Maha. with the objective of so developing the catchment areas as to protect their ecology, reduce soil erosion, ~~to protect the reservoir & the dam~~, ~~&~~ ~~to~~ provide gainful employment ~~[illegible]~~ to the people & necessary civic services like water supply, ~~electricity~~, power, waste disposal facilities, medical help, education etc. to the villages. Ecologists should be appointed on this authority.

2. Ecologists should be appointed & others on Command Area D A in order to ensure that the ecology of the areas is not unduly disturbed. ~~[illegible]~~ ~~their development along~~ ~~[illegible]~~

tech. persons advising the Govt. in planning

3. Once a decision to build a dam is taken ~~[illegible]~~ surveys should be undertaken to gauge the biological wealth of the catchment & to suggest measures to protect the ecology of the catchment areas. Protective steps should be undertaken before the commencement of the dam ~~[illegible]~~ construction

4. In order to protect the remaining biological wealth of the catchment of Panshet dam, heavy vehicles except ST Buses should be banned on the roads leading into the catchment & transport of wood & charcoal should be banned (out of the catchment.) W. Ghats wildlife Sanc. Similar measures should apply to the catchment of Varasgaon dam.

5. All laws intended to improve the quality of life in urban & rural areas should be strictly enforced.

6. Regional Planning Authority for the Pune Region on the lines of BMRDA should be formed immediately & ecologists should be represented on it.

7. In ecologically fragile areas such as high mountains, deserts, seashore, forests etc. ecological surveys should precede developmental projects ~~such as road building~~ etc. & the engineers should receive ~~ecological~~ grounding in ecological considerations involved in such work.

8. Training in ecological considerations should ~~form~~ be included in all refresher & orientation courses for engineers & other technicians involved in developmental projects.

9. Ecologists should be included in all technical committees dealing with planning

10. When irrigation is brought to areas with low & irregular rainfall (< 25 inches) it is necessary to prevent salinisation of farm lands caused by evaporation & water-logging. It is therefore, recommended that irrigation should also be made available to grow nutritive grasses, fodder crops & trees which would result in more balanced use of water ~~the lowering of salinity & waterlogg.~~

11. Arid zones have their own distinctive ecology. When water is brought to such areas, the inhabitants should be encouraged to take up ranching, & improved pastures, cultivation of fodder & other trees instead of taking up traditional agriculture which proves destructive to soil & ecology of these areas.

Society for Promotion of Wasteland Development
Shakti Bhawan Annexe
11-A Vishnu Digambar Marg
New Delhi 110002
Panel of ecologists

India Crane Centre

Birds to be kept first.

i) Sarus pairs & juveniles.

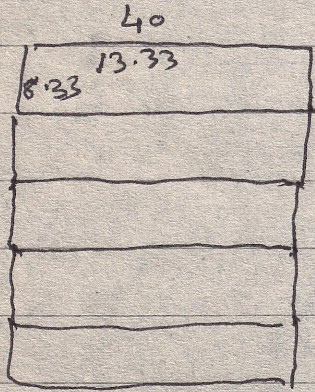
ii) Eastern Sarus to be added

iii) Siberian & Blacknecked to be added later.

iv) Together with ii- Barheads & Whitewinged wood duck

Land

One crane pair : 40' x 25'



= 1000 sq. ft.
= 1000 sq. ft.
= 1000 sq. ft.
= 1000 sq. ft.
= 1000 " "
} 5000 sq. ft.

Nylon Netting : 4000 sq. ft.	Rs.		approx
Ground fitting = 2000 sq. ft.	10,000		15,000
2 pairs Sarus =	1500/-		
Juveniles 4 =	1200/-		
Staff caretaker 12x500	6000/-		approx
Food & care 12x300	3600/-		15,000
Misc.	1700/-		