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Editor

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Foreword

This issue of the Journal of the Ecological Society is slim and trim but fit for being that. I assess its fitness from the quality of the writing in it. No one will deny that the unchecked growth of population in India has wreaked havoc to the country's ecology. Our programmes for the protection of our unique wildlife, the conservation of our unsurpassing biodiversity, our once extensive and productive wetlands have been dealt mortal blows. We remain somnolent towards the crisis which is well and truly upon us. Our political leadership is inane, it displays a supreme unconcern for anything to do with Nature and its uncompromising laws. They scarcely understand, let alone recognize, the immutable law that anyone or anything which is in conflict with Nature must eventually decline and disappear from the face of this planet. Vasundhara is no longer Veerabhogya! All this and more is very clearly spelt out in the five articles within. So read on . . . .

This issue of the Journal would not have seen the light of the day had not Airfreight Ltd., Forbes Marshall and Thermax Ltd. had come to our assistance. Would that there were more such entrepreneurs in this country! We express our sincere thanks to them. I cannot but agree, looking at the proliferation of governmental organizations pushing the environmental cart, that many of us have duplicated or triplicated their programmes with the result that those few entrepreneurs who would like to assist are a trifle bewildered and unsure that their monies would be properly applied. Will the NGOs get their act together? Being Indians I doubt it very much!

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Is Man a Part of Biodiversity?

Prakash Gole

Is man a part of biodiversity? This question came to my mind while reading a book titled 'People and Protected Areas' edited by Ashish Kothari, Neena Singh and Saloni Suri. These protected areas are supposed to protect biodiversity. On paper they cover slightly more than 4% of the total area of the country. In theory they are to be kept inviolate to protect and conserve all the non-human beings that they hold including plants, and also including all the physical features their eco-systems contain. In reality all of them are inhabited by substantial numbers of human beings who interact with these eco-systems in various ways. In addition, these protected areas (PAs) are threatened by civilizing, commercial and technological forces which want to use these landscapes for purposes other than the protection of biodiversity.

Biologically speaking the interests of a single species are pitted against millions of other species that inhabit India's land and waters. Already this single species, Homo sapiens, has appropriated almost 96% of the nation's area for its own use. Now it is also being claimed that a section of this species is like any other nature's creature and should therefore, be allowed a share in their cake. The civilized section of humanity has already established its domain over 96% of the land. Now it is claimed that a tiny section of humanity should have a share in the remaining small portion because they live close to nature like any other non-human being. This is the gist of the argument. Put this way, does this demand not appear a gross injustice? Yet some of our radical humanists, activists and social reformers are demanding exactly this share. Justice demands that they should rather stake their claim on that extraordinarily large chunk of the loaf that is already appropriated by the civilized section.

But this is not to be. The result is, this tiny chunk of our land and water scapes is under pressure from not only the already civilized, all conquering humanity but also the so-called sons of the soil. If either of the demands is conceded the result, I feel, will be the same immediately or in the near future. Eventually these so-called protected areas will come under increasing anthropogenic influence denying many non-human beings including plants, insects, birds and animals (terrestrial, arboreal, aquatic and marine) living space, leading to the extinction of many of them.

Why I cannot think otherwise is because protagonists of both these points of view seem to keep mum on many of the questions that trouble my mind as I go through their arguments.

In his excellent introduction to the book 'People and Protected Areas', editor Ashish Kothari has summed up these arguments. As he points out, the attitude of the dominant elite including political leaders of all shades towards nature, is that nature is a resource to be exploited, a big supply depot for the benefit of man. As a result in the present political and administrative system, laws of acquisition and use of natural resources are far more powerful than those governing conservation. The former comprise 85% of the total while the latter are mere 15%. Given this proportion and the general consensus among all political parties on this issue, it is far easier to denotify a protected area than to create one. It is even easier to permit commercial, tourism-oriented and industrial activities within the PAs than to keep certain areas inviolate for the exclusive wild life use.

The government policy in this respect, as in others, is neither here nor there. The ostensible purpose of creating a protected area is to conserve natural eco-

systems therein, including wildlife and to ensure the livelihood security of local traditional communities. Yet the Government at the Centre, under pressure from the state governments, has found it expedient to allow mining, irrigation and power projects within the PAs. With the creation of a sanctuary or a national park, the government machinery always finds it easier to extinguish the rights of local people than to take effective steps for their rehabilitation. Though local people have been evicted only in a few cases, their future remains uncertain and they live under constant threat due to vague and indeterminate policies of various state governments. Moreover the PAs are managed in such a way as to leave limited or no scope for the people to derive benefits from their creation. Again in many PAs it appears that more weightage is given to collection of revenue from tourism than to the preservation of wildlife interests. On the whole therefore, the claim made by social activists rings true and genuine. The creation of a protected area puts local people to a great disadvantage.

But who are these local people? According to some of the activists they are the original inhabitants of the area. As Kothari points out however, the original inhabitants really are the plants and animals which occupied this planet millions of years before man. No legal system recognizes their rights, including occupancy right in their habitats. Certain tribal cultures, in their customs and religious observances do tacitly concede these rights and even worship plants and animals. It is these and the traditional tribal life-style woven around them, that will protect forests and their wildlife, argue many social activists. Tribals of more or less this genre occupy areas in central, south-western and north-eastern India. But in a heavily industrialized and "progressive" state like Maharashtra, the people living within the PAs are certainly not all tribals. The average human population per protected area in Maharashtra is 11,610 writes Pardeshi, an IAS officer of the Maharashtra cadre. The human population per square kilometer of protected area varies from 3 in Nawegaon to 1960 in Borivli. In most of the protected areas cattle population is also very high: from 87 per sq. km. in Kinwat to 13 in Melghat. Besides cattle there are goats and sheep, whose population varies from 21 per sq. km. in Tadoba to 35 in Pench. Tree felling is rampant in 58% of the PAs and minor forest produce is extracted from 67% of these. Other avenues of interference are roads, quarrying, hydel projects and last but not the least, commercial tourism. The picture of protected areas in other states is not much different. Rights or no rights, this small chunk of our country, though captioned protected areas, appears to be under all-pervasive anthropogenic influence. They are certainly not pristine natural habitats.

Now if you champion the rights of wildlife and talk about our duties towards them, you are accused of treason, though in civil language you are billed as a deep ecologist. In the language of the street or of politics, you are no less than a traitor. Yet a look at the above figures will convince anyone that wildlife has a far stronger case than people who demand a share in their shrinking habitat. People can have alternatives, wildlife cannot. The social activists appear to argue that these people cannot and should not have alternatives. In effect they demand that these people should be treated as an integral part of biodiversity.

How do we protect our biodiversity? Principally, by minimizing any interference in their lives and habitats. The core and buffer zones in our protected areas are supposed to achieve these. Can we prescribe this same hands-off policy to the inhabitants of these areas if they are really a part of bio-diversity? The government machinery seeks to rehabilitate these people outside the core and possibly also the buffer areas; though they would like to offer them a share in the benefits such as employment opportunities within the forest and in tourism industry. Social activists demand a share for these people in the biomass to fulfill their needs and also insist that they be allowed to continue their life-style as it was. But they would also like to offer them modern education, medical help and bring about changes in their life-style by introducing social forestry, smokeless chulhas, solar cookers, biogas, handicraft training, participation in the works of catchment area development etc. All activists bemoan lack of roads, hospitals, educational facilities for the tribals. They seem to be unaware that there is a basic contradiction involved in their stand. Once they have access to these facilities they can hardly continue their old life-style. Ms Karnik succintly puts the view of tribals when she says that they would consider themselves poor only in relation to the goods in the market. But if they have their granaries full, their cattle satisfied, and their kith and kin around them, they are happy and rich inspite of the market. Unfortunately the provision of all the above facilities brings them ever closer to the market economy. In reality, except a few areas in remote Arunachal Pradesh, none of the protected areas is far away from commerce and trade. Even in Arunachal hundreds of trucks daily carry thousands of cubic feet of prime forest to markets in the plains: a result of sale of tribal rights by people

and their government to market forces. If tribals and others have inalienable rights over the forest produce, the nearness of markets will tempt them to go for immense short-term benefits by trading these rights. Saw mills are busy even in the remotest corners of Arunachal Pradesh.

Social activists appear to dither on the continuance of the practice of shifting or jhoom cultivation also. Many of them believe that given a long fallow period (15 to 30 years), this is the most sustainable form of agriculture. This may be true as far as soil fertility is concerned, but is inconsistent with rising aspirations brought about by education, decline in mortality and rising population. Moreover, it is foolish to believe that prime forest, a result of thousands of years of evolution, will, if cut down, regenerate in a span of 15 to 30 years. The prime forest will undoubtedly be replaced by a secondary forest in which the character of biodiversity will be quite different from the original; so will be the character of wildlife. Denizens of the prime forest will have no place in a regime under jhoom cultivation. My survey of the forests of the Sahyadri has revealed that 35 species of birds are on the brink of disappearance from the Sahyadri due to destruction of old canopy forests. With every jhoom cycle the quality and quantity of biodiversity is going to decrease and not increase. The practice is definitely inimical to biodiversity conservation in our protected areas.

The numbers of cattle, sheep and goats in our PAs also pose an insurmountable problem. Everyone seems to agree that their number is excessive. In particular the number of unproductive animals far exceeds the productive ones. For Bhimashankar Dr Borges suggests a buy-back scheme for cattle, limiting the number of cattle per family and their increase. Bittu Sahgal, while conceding the right of Gujjars to graze their animals in the Rajaji National Park, seems to be indecisive about their numbers and the number of Gujjars that should reside in the park area. Here again the main cause of conflict appears to be the market economy that pervades the lives of all of us. It is futile to try to keep Gujjars and others isolated from the market economy. They are conscious of the gains from being connected to the markets and eventually to all the conveniences and glitter of modern civilization. The case of Gir National Park or for that matter any PA from Maharashtra and other states is similar. It is the nearness of trade and commerce that is bringing about a slow or rapid transformation in the life-styles of the so-called original inhabitants of the PAs.

The current position is that the nature conservationists and social activists are slowly coming to agree on the policy of allowing the inhabitants of the PAs to obtain a share in their biomass and indeed in their space as a matter of right. From the wildlife point of view I consider this an unfortunate development. Not that I am against tribals and the other affected people. I consider this unfortunate simply because the demand is not based on sound factual and scientific considerations. On the nature conservation side we have little data on the needs and habitat specifications of most of our animals and birds. We may have data on such large and spectacular animals as the Tiger, the Elephant and the Gaur. But we lack data on smaller animals, birds, marine animals etc. that are relevant to the considerations of the carrying capacity and management of PAs. No forest and wildlife department in any state has a research policy as an inseparable adjunct to its management system. Except probably in Bharatpur no other PA has set in motion a system of continuous collection of wildlife and plant data relevant to management. In the absence of these no one really knows if the area declared as protected is adequate to the present and future needs of wildlife, whether it allows room for increase in their numbers, whether the designated core areas really reflect the biological core.

On the social side scientific studies of the community/forest interrelationship are scarce. No one has ventured to study their exact quantum of dependence on forest or the extent of their alienation from the local environment. Are the local community organizations, structures and practices intact? Are the communities cohesive? Or are they divided on the basis of castes and religions? How the total biomass is to be divided among different communities? What will happen if a dominant community or village claims a larger share to itself as happened in Ranthambhor? How this sharing will affect indigenous flora and fauna? What is the impact of village upliftment measures on the surrounding eco-systems?

We need tremendous quantities of data and their assessment to devise a solution based on scientific considerations. All this effort is time-consuming and expensive. By the time we complete this enormous task, if present conditions are allowed to continue, this tiny chunk of our landscape (the PAs) with all its remaining biodiversity will undergo transformation beyond all recognition. The demise of most of our indigenous flora and fauna will not be far away.

Most of the developed world has already witnessed the demise of biodiversity. In 300 years between 1600 and 1900 A.D. 75 animal species became extinct. In the

next just 60 years i.e. between 1900 and 1960 another 75 species became extinct. After 1960 this extinction process was greatly accelerated and 1000 species of all sorts began to disappear from this planet every year. The speed with which we are destroying tropical forests and other habitats means by the end of this century the planet will be losing 40000 species per year! (Norton 1987). This rate exceeds all previous extinction rates. In the past the planet has witnessed five large-scale extinctions of species. But the process continued for thousands of years. The most talked about extinction, that of the Dinosaurs in the Mesozoic period lasted almost 50,000 years. Compared to it the present speed is extremely fast and total extinction may be achieved in a few hundred years!

What is the alternative? Can we save our flora and fauna while still ensuring social, cultural and environmental justice to traditional local communities and tribals? I think we can if social activists and nature conservationists pool their knowledge, strength and resources to claim a larger share from the 96% area rather than a diminishing share from the 4% PAs. Degradation due to bad or unscientific management covers extensive areas. Many of these adjoin PAs. There are degraded revenue lands and forest lands. The government and NGOs should assist traditional communities to develop these areas as suited to satisfy their needs of biomass. Social activists should help them resettle in these areas according to their social and cultural customs. Our protected areas need to be buffered by an even larger area devoted to peaceful interactions between wildlife and man. In reality it may involve a carefully thought out scheme of compensation. This inevitable expenditure must be borne by the market economy through probably an environmental tax on our techno-industrial-commercial world.

What I am suggesting is a nationwide, labour intensive, employment-oriented and decentralized scheme of restoration of nature based on peoples' participation.

Pioneers like Annasaheb Hazare have initiated a village-level movement of social and economic reconstruction with peoples' participation. Their schemes of village upliftment must be generously leavened with the incorporation of elements of restoration of nature, i.e. restoration of habitats in the hills, around streams and rivers, and in grasslands, and rocky and unculturable waste. Every village settlement should become an integral part of the surrounding natural eco-systems. These eco-systems should be able to provide the basic necessities not only of the people but of the wildlife also. The 4% area declared as the zone for the protection of biodiversity should be treated as a gene bank. It is the nearness of such gene banks which is essential to initiate the process of natural regeneration. The gene banks can only be made active and fully operative by controlling the activities of man and his domestic animals. If people are made aware of the benefits of natural regeneration and are trained to promote it, they will be willing to organize and plan their activities in consonance with this objective. Family planning and better management of domestic animals will then form an integral part of village life, not something brought for them from outside.

But this will entail a radical shift in the philosophy of education. Like the system of law and administration, the current system of education also gravitates around exploitation of nature. It leads to a rise in material aspirations without in any way providing a sustainable base for them. In plain terms it ignores the fact that economic development to be successful needs a strong and sound natural foundation.

Both nature conservationists and social activists should realize that market economy is the main destructive agent of wild flora and fauna and human traditions that sustain nature. It is this agent that must be made to pay to rejuvenate nature by shelling out money, space and a large share of natural resources that it wants to gobble. Traditional communities should not claim a share in the remaining biodiversity but should be involved in a nation-wide, labour intensive programme of natural and environmental regeneration. Opportunities that such a programme offers in terms of productive employment are beyond all expectations.

The question I raised at the beginning of this article can now be answered. Man in his present state of evolution cannot be considered a part of biodiversity. He has sufficiently distanced himself from all other nature's creatures to constitute a separate realm. But his dependence on nature has not decreased. It is in his interest to protect nature in all its quantity, variety and quality.

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The Disappearing Tank Culture of Rajasthan

Rakesh Vyas

Key words : tank culture, communities, waterfowl, socio-economic impact, breeding.

Introduction

Tank-culture in India is as old as the history of its civilization. The ancient Sanskrit literature is full of references about the importance and utility of tanks. The wisdom contained in the Vedic literature in the form of Sanskrit verses is as relevant today as it was 5000 years ago. The Rigveda, the oldest of all Vedas contains verses on the importance of tanks as a run-off water harvesting system. The Atharvaveda contains a number of verses propagating the construction of tanks and urges Kings to create such facilities for the general populace, wherever possible. Around 200 A.D., a great philosopher, astronomer and scientist, Varahmihir, wrote a whole treatise on the construction and maintenance of tanks (Brihatsagar, circa 200 A.D.). Kalidasa, a contemporary poet of Varahmihir was a naturalist and has dwelt deeply on the proliferation and beauty of the tanks in his works 'Meghdootam' and 'Abhigyan-Shankutalam'. There are hundreds of ancient tanks in India and one was recently discovered at Sringapverapura near Allahabad, which is well over 2000 years old. The lakes of Pakhal, Ramappa, Lakhavaram and Sanigaram in the districts of Warangal and Karimnagar in South India were constructed in 12th and 13th centuries. The British chroniclers in 1856 found extremely rich and flourishing tank-culture in south and east India. The southern part of central provinces and the parts of Rajputana (now Rajasthan) situated east of Aravali mountain ranges have natural and man-made tanks. This method of harvesting run-off water was extremely successful in low to moderate rainfall areas.

The purpose of the present study was to investigate the present status of tanks in south-east Rajasthan and the fate of communities dependent on them. In India, various communities have ecological niche diversification (Malhotra and Gadgil) which is also evident among the wetland dependent communities known as Bhoi, Kahar, Keer and Mallah. They are respectively fisherfolk, Trapa and Lotus cultivators, vegetable growers and boat people.

South-east Rajasthan is known to have a rich avifauna due to its strategic location between arid desert on the west and the Deccan plateau on the east. Various migratory waterfowl use it as a stop-over on their southward movement, whereas a number of resident and migratory waterfowl are found in the study area. As nothing much has been documented on the waterfowl of Kota, it was chosen to study the impact of vanishing wetlands and degraded watersheds on the diversity and breeding of resident birds.

Material and Methods

This study was conducted on the natural and man-made tanks of Kota and adjoining villages during 1989-1993. Kota city is situated on the banks of the Chambal river in south-east Rajasthan on 25°10'N latitude and 75°52'E longitude. In all 22 tanks were surveyed. The village tanks fall within a distance of 25 kms from Kota. Very little documented information is available on the wetlands. However, official data on certain irrigation tanks were collected from the departmental sources. Thus, personal observations were made to evaluate the present area and status of the tanks. Interviews with the villagers and senior citizens of the city yielded relevant information on the past

history of the tanks. Information on tanks built and maintained by the royalty of Kota is collected from the city archives.

Inverviews with the community elders and leaders were conducted on a regular basis. Currently, only two wetland dependent communities have remained in the area namely Bhoi (fishing) and Kahar (cultivation). The other two, viz. Keer (vegetable growers) and Mallah (boat people) have migrated due to multiple dams on the Chambal river.

The tanks were visited at regular intervals. Records were maintained for about 600 visits. The waterfowl were observed with a Minolta 8 x 40 binocular and a Konus telescope. The breeding site records of ducks and herons were separately maintained. The past breeding records have been collected through personal communications with interested birdwatchers.

Results

Tanks — Past and present : Kota receives moderate precipitation (average 786.46 mm, 1956-82) every year. The fine textured clay loam soil up to a depth of 200 cms. is non-calcareous and has slow to moderate permeability (Verma B. 1986). The run-off water from the stony upland, south-west of Kota drains into the Chambal river and its tributaries as well as fills natural depressions, providing scope for creating small to fairly large tanks by constructing earthen or masonary bunds on one or more sides. The erstwhile rulers of Kota were highly inclined towards creating this facility for the masses and also used these tanks as recreational and resting sites for themselves and royal visitors. Abheda, Jawahar sagar, Kishor sagar, Ranpur, Lakhawa and Ummedganj tanks are 200 to 500 years old. Palaces or their ruins may still be seen on the banks of these tanks.

In all 22 tanks were studied. The results are summarised in Table 1. The results indicate that 3 tanks have become defunct due to the building of concrete structures and dwelling sites erected in the tank beds and their catchment. This has led to repeated flooding of the residential colonies during monsoon in Dakanya talab, Ganeshpal and Chhatrapara tank area. Five tanks including the historical Kishorsagar, Soorsagar and Ummedganj tanks are now a part of the canal system arising out of the kota barrage and drain into the right main canal (RMC). They can no longer be termed as tanks because presence or absence of water in the reservoir and the canal depends upon the irrigation schedule rather than on the needs of traditional beneficiaries of the tanks.

Out of the remaining 14 tanks, 5 are within Kota city and remaining 9 are multiple-usage village tanks. The available records of Lakhawa and Ranpur tanks suggest that the storage area has invariably shrunk by 50% to 80% due to wetland degrading factors, viz. 1. Deposition of silt, 2. Seasonality, 3. Eutrophication, 4. Leakage/seepage, 5. Poaching/hunting, 6. Non-sustainable economic activity. The status in Table 1 is based on these factors :

a. Very poor : indicates involvement of 5 to 6 factors.
b. Poor : indicates involvement of 3 to 4 factors.
c. Moderate : indicates involvement of 1 to 2 factors.
d. Good : indicates absence of degrading factors.

According to the present status, 8 out of 22 tanks studied are defunct, excluding one tank which has been filled by ash-slurry generated by Kota Thermal Power Station. Five tanks are in a very poor condition due to degradation factors stated above. Six have been placed under the poor category and two in the moderate category. No tank could be termed Good because degrading factors were totally absent from none.

Wetland Dependent Communities

Traditionally four communities are utilizing the wetlands for their livelihood. *Bhoi* are the traditional fishermen, who catch fish for their own consumption and trade. Certain families among them have diversified into *Trapa* cultivation. This has happened due to a dwindling fish catch and religious beliefs. The *Kahar* community is engaged in *Trapa* and Lotus cultivation in tanks and waterholes. *Keers* grow vegetables on the sandy tank and river beds. Their chief crops are cucurbits, mainly water melon. *Mallah* are boat people, who earned their living by ferrying people across rivers on riverine water ways.

Since the construction of four mega dams on the Chambal river upstream and Kota between 1950 and 1970, the *Mallah* community lost its source of income. They have migrated to downstream locations on the Chambal river, where people still need boats to cross the river. No active boat family could be traced in the study area. The river bed is no more sandy, the tanks are filled with silt, thus forcing the *Keer* community also to leave Kota. The community still practises its age old vocation near Parban river and other tributaries east of Kota.

The *Bhoi* community has approximately 300 households in Kota city. A majority of them still practise their traditional vocation. The community members have formed a co-operative society, which takes a long term fishing lease on local tanks and canals. However, this society has a very loose working structure. Since its members work in family parties rather than as a

cohesive group, the whole operation is still traditional, unscientific and non-remunerative. Fish catch collected legally or illegally reaches the market through a powerful lobby of middle men. Gradually, the local society is losing ground and financially sound traders of eastern Uttar Pradesh and Bihar have procured the fishing rights on all the major dams, lakes and tanks in the state. The living standard of the community is below poverty line which is further compounded by illiteracy, resulting in social evils like gambling and alcoholism.

Kahar community is relatively small with only 60 households residing in Soorsagar area of Kota at present and 115 in adjoining areas. According to community elders, more than 200 families have gone out of Kota. Although economically, they are as backward as their other wetland dependent brethren, socially they are better organized. Six to 7 members of this community are employed in governmental agencies. *Kahar* community also has a co-operative society, which procures sub-leases from fishermen's society to cultivate *Trapa* and exploit Lotus flowers, stems and fruits. There seems to be no provision for providing them direct leases for Trapa cultivation. They have to work on small plots of roughly half to one hectare, thus making the work more cumbersome and less paying. Water hyacinth has gradually choked the wetlands, causing crop loss in Kala talab, Moiyo ka talab and Kishorsagar. The average per hectare yield amounts to Rs. 40,000 ($1200) annually.

Waterfowl

The list of observed waterfowl in the study area is given in Table 2. A total of 96 species from 20 families is found in the study area. Out of these, 55 waterfowl species are migratory and remaining 41 are resident. Their movements are dictated by the local water conditions. The impact of receding wetlands on the breeding of the resident waterfowl was evaluated by comparing the old records and information collected from knowledgeable people. The findings suggest that 38 resident species used to breed in and around Kota (Bharat Singh, Shantanu Kumar, Soni R. G. pers. com.). During the study period, 20 species were seen breeding and juveniles of 13 species were regularly seen in the post breeding period (Table 2). This fall in numbers is mainly evident among the tree nesting birds like Comb duck *Sarkidiornis melanotos;* Whistling teal *Dendrocyana javanica;* Cotton teal *Nettapus coromandelianus;* Indian cormorant *Phalacrocorax fuscicollis;* Darter *Anhinga melanogaster;* Grey heron *Ardea cinerea;* Great egret *Egretta alba;* Storks and Ibises. Among the ground nesting species, Yellow Wattled Lapwing *Vanellus malabaricus;* River Lapwing *V. duvacelli;* Stone Curlew *Burhinus oedicnemus* were not seen nesting. The breeding attempts of Great stone plover *Esacus magnirostris* failed twice at the Alniya and Abheda tanks due to submergence of the island in the last week of June and early July in 1992 and 1993.

Cormorants, Egrets, Herons mostly nest on *Acacia* sp., *Prosopis, Azadirachta indica, Dalbergia sisoo, Tamarindus indica* and *Ficus religiosa*. In 1991 and 1992, breeding failure was also noted among reed nesting birds, in a stretch of 6 kms. on RMC. *Typha* was exploited on a large scale between February and May causing loss of nests of Sarus crane *Grus antigone,* Purple swamphen *Porphyrio porphyrio,* White breasted waterhen *Amaurornis phoenicurus* and Indian moorhen *Gallinula chloropus.*

Discussion

Tanks and Dependent Communities : The results of the present study reveal that only 9% of the tanks come under the moderate category while 51% could be categorised as poor or very poor and 40% have become defunct due to various reasons (Table 1). This state of affairs could be attributed to the lopsided development, utter neglect in planning, eutrophication, municipal and industrial waste disposal in the tanks and degraded catchment areas. The waterbodies choked with Hyacinth, *Typha* and algae have low percentage of dissolved oxygen causing significant reduction in aquatic fauna. It was found that Hyacinth competes with other vegetation of economic importance and particularly marginalises *Trapa.* The weedicide effective against Hyacinth is also lethal to *Trapa.* The poisoning of fauna due to pesticide wash was particularly evident at Ranpur tank in 1991, when hundreds of fish perished within a day. The indiscriminate use of carbamate insecticide like Sevin on stemborer in *Trapa* was also observed. The cultivators are not aware of the toxic effects of residual pesticides on man and its lethal effect on fishes. They use wasteful quantities of pesticide (3.5 kg/ha). Experts do not favour the use of chemical pesticides in the waterbodies. The industrial wastes cause eutrophication. The extent of damage depends on its constituent chemicals. An extreme example of the problem of industrial waste disposal is Jawaharsagar, which is completely filled up with the ash slurry of Kota Thermal Power Station, rendering it useless as a tank or wetland habitat for waterfowl. Part of Ummedganj tank has been completely drained. Ranpur and Anantpura tanks are regularly drained every year in

January to create space for crops. The residual impacts of such practices are loose soil, pesticide and fertilizer contamination which remain in the tanks in the following monsoon season. Tanks which have agricultural fields in their catchment suffer similar effects. The degraded catchment areas are an environmental disaster for the region. Depleted vegetation cover, overgrazing and tree felling have left the top soil barren resulting in erosion, deposition of soil in tank beds. Without soil binding, water retaining root systems, there is no water retention in the lakes and streams. Acute water shortage is the result inspite of normal precipitation.

Following measures are recommended to overcome the problems and to restore the traditional tank-culture in the study area.

Short term :

1. Removal of silt.
2. Proper maintenance of bunds to reduce leakage/seepage.
3. Restrengthening of bunds with tree/bush cover.
4. Remove excessive weeds choking the tanks.
5. Reduce wasteful pesticide/fertilizer use through awareness campaigns.

Long term :

1. Treat all organic waste, sewerage before release into the waterbodies.
2. Do not permit the disposal of industrial waste in multipurpose tanks.
3. Apply watershed development techniques to improve the catchment area of the tanks.
4. Promote afforestation practices to bind the soil and retain water.
5. Application of soil conservation techniques.

Predicted benefits to Dependent Communities - Restored perennial tanks will immensely improve the economy and life style of the dependent communities. Unscientific fishing practices are adopted by the Bhoi community because of poverty rather than lack of knowledge. Economic deprivation does not allow the community members to adopt superior technology and sustainably exploit the available resources. The practice of starting the fish catch early in the season which has an adverse impact on the total output needs to be eliminated. The undesirable and commercially nonlucrative fish varieties like *Mastacambelus armatus*, *Mystus* sp., *channa* sp. are prevalent in the tanks. Perennial tanks and seepage marshes near Kotri tank, Soorsagar, Raipura tank and Ummedganj tank will be ideally suitable for rearing commercially remunerative fishes like *Labeo*, *Catla*. Illegal practices such as the use of small gauge nets and interception of fish fry from the streams feeding the tanks also has an adverse impact on the output of fish.

This situation in the study area could be corrected by imparting scientific training in sustainable pisciculture with NGO support. At the same time governmental support in the form of extension education, formation of workable co-operative societies, soft loans to upgrade the technology, community welfare programmes, if provided, would immensely benefit the *Bhoi* community.

The practice of leasing the shallow tanks and waterholes for *Trapa* and Lotus cultivation should be restarted. Presently it is a short term vocation for the community resulting in inefficient utilization of available man power. The plants are looked after between July-September and fruits are harvested in the months of October and November. In the seasonal tanks, fresh root stock is planted each year increasing the work load, whereas a few remaining perennial waterbodies retain their own root stock which is looked after by the cultivators between March and June. If restored, the perennial tanks will allow the Kahar community to harvest *Trapa* twice a year, thus improving the economy of the people. An awareness programme among the Kahar community to reduce the use of pesticides and promote the use of biological pest control methods must be conducted so that they can sustainably utilize the wetland resources. The community welfare programmes like literacy, health, training and proper marketing of the produce will go a long way in bringing about economic and social upliftment of Kahar community.

Waterfowls : The tank restoration activities, which are expected to help the resident waterfowls, will provide a. perennial availability of habitat, b. trees/bushes to breed close to the tanks, c. foraging and roosting sites, d. ensure absence of toxic waste in the tanks. A visual example of such attributes is the Abheda tank. It was a seasonal waterbody until 1991, when the bund was repaired to stop the leakage. The following year, Spotbill duck *Anas poecilorhyncha*, Little grebe *Tachybaptus ruficollis*, Pheasant tailed jacana *Hydrophasianus chirurgus*, Whitebreasted waterhen *Amaurornis phoenicurus* started breeding in the tank.

On the basis of this study, I strongly recommend the restoration of tank-culture in south-east Rajasthan and Kota, especially to bring back the past glory of the wetlands and to improve the lifestyle of the dependent communities and waterfowl.

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Table 1 : Tanks of Kota and adjoining villages and their problems

S. No.	Tank	Nearby City/ village	Natural Masonary Earthen Seasonality	Approx. Area	Present Status	Economic Activity	Dependent Communities	Problems
1.	Kishorsagar	Kota	M H P	25 Hect.	Part of reservoir poor	Trapa Fishing	Kahar	1, 2, 5
2.	Kotari Tank	Kota	N P	—	Part of canal defunct	Fishing Lease	Bhoi	1, 2, 5
3.	Kansua Soorsagar	Kota	N P	—	Part of canal defunct	Fishing Lease	Bhoi	1, 2, 3, 5
4.	Kala Talab	Kota	N S	5 Hect.	V. poor	Trapa Fishing	Kahar	1, 2, 5, 6
5.	Dakanya Talab	Kota	N	—	Defunct	—	—	—
6.	Chhatrapura Tank	Kota	N	—	Defunct	—	—	—
7.	Ganesh Pal	Kota	M^+	—	Defunct	—	—	—
8.	Abheda Tank	Kota	M^o H P	8 Hect.	Moderate	Fishing Trapa, Lotus	Bhoi Kahar	5, 6
9.	Jawahar Sagar	Kota	M^o H	20 Hect.	Ash filled Defunct	Typha	—	3

10.	Nanta Tank	Kota	E^{o} S	5 Hect.	Poor	Fishing	Bhoi	2, 5, 6
11.	Moiyo ka Talab	Kota	E^{+} S	2 Hect.	V. poor	Trapa	Kahar	1, 5, 6
12.	Raipura Talab	Raipura	M^{+} P	—	Part of canal defunct	Partly fishing lease, Typha	—	1, 3, 5, 7
13.	Ummedganj Tank	Ummedganj	M^{o} H P	—	Part of canal defunct	Partly fishing	—	4, 5, 6
14.	Nayagaon Tank	Nayagaon	M^{+} S	10 Hect.	V. poor	—	—	4, 5, 6
15.	Borabas Tank	Borabas	M^{o} S	10 Hect.	V. poor	—	—	4, 5, 6
16.	Lakhawa Tank	Lakhawa	M^{o} H S	80 Hect. Official	Poor 10 Hect. (av)	—	—	2, 5, 6
17.	Ranpur Tank	Ranpur	M^{o} H S	130 Hect. Official	Poor 40 Hect. (av)	—	—	2, 4, 5, 6, 7
18.	Raontha Tank	Raontha	M^{+} P	20 Hect.	Moderate	—	—	2, 5, 6
19.	Anantpura Tank	Anantpura	M^{+} S	20 Hect.	V. poor	—	—	4, 5, 6, 7
20.	Morpa Tank	Morpa	E^{+} S	5 Hect.	V. poor	—	—	1, 2, 5, 6
21.	Karadia Tank	Karadia	E^{o} S	8 Hect.	V. poor	—	—	1, 2, 5, 6, 7
22.	Simalya Tank	Simalya	E^{o} P	10 Hect.	Poor	—	—	2, 4, 5, 6, 7

N - Natural, M - Masonary, E - Earthen, ^{o} - Two/more side bund, $^{+}$ - One side bund, H - Historical, S - Seasonal, P - Perennial

Problems :

1. Choking with Water Hyacinth/Typha reed/Algal bloom.
2. Human/Municipal waste disposal.
3. Industrial waste disposal.
4. Tank drained for cultivation/habitation.
5. Poor maintenance.
6. Degraded catchment.
7. Cultivation on margins (Pesticide/fertilizer wash off).

Table 2 : Waterfowl of Kota

Family		Waterfowls			
Podicipedidae	1.	Little Grebe	Tachybaptus ruficollis	R	B
	2.	Great Crested Grebe	Podiceps cristatus	M	
Pelecanidae	3.	Great White Pelican	Pelecanus onocrotalus	M	
	4.	Dalmation Pelican	P. crispus	M	
Phalacrocoracidae	5.	Indian Cormorant	Phalacrocorax fuscicollis	R	J
	6.	Javanese Cormorant	P. niger	R	B
	7.	Great Cormorant	P. carbo	M	
Anhingidae	8.	Indian Darter	Anhinga melanogaster	R	J
Phoenicopteridae	9.	Greater Flamingo	Phoenicopterus ruber	M	
Ardeidae	10.	Grey Heron	Ardea cinerea	R	J
	11.	Purple Heron	A. purpurea	R	B
	12.	Great Egret	Egretta alba	R	
	13.	Intermediate Egret	E. intermedia	R	J
	14.	Little Egret	E. garzetta	R	B
	15.	Cattle Egret	Bubulcus ibis	R	B
	16.	Blackcrowned Night Heron	Nycticorax nycticorax	R	B
	17.	Green backed Heron	Butorides striatus	R	
	18.	Indian Pond Heron	Ardeola grayii	R	B
	19.	Eurasian Bittern	Botaurus stellaris	M	
	20.	Cinnamon Bittern	Ixobrychus cinnamomeus	R	
Ciconiidae	21.	Painted Stork	Mycteria leucocephala	R	J
	22.	Asian Open Bill Stork	Anastomus oscitans	R	J
	23.	Black Stork	Ciconia nigra	M	
	24.	Wooly Necked Stork	C. episcopus	R	J
	25.	White Stork	C. ciconia	M	
	26.	Black Necked Stork	Ephippiorhynchus asiaticus	M	
Threskiornithidae	27.	Oriental Ibis	Threskiornis melanocephalus	R	J
	28.	Black Ibis	Pseudibis papillosa	R	J
	29.	Glossy Ibis	Plegadis falcinellus	M	
	30.	White Spoonbill	Platalea leucorodia	R	J
Anatidae	31.	Indian Whistling Duck	Dendrocygna javanica	R	J
	32.	Greylag Goose	Anser anser	M	
	33.	Bar Headed Goose	A. indicus	M	
	34.	Ruddy Shelduck	Tadorna ferruginea	M	
	35.	Comb Duck	Sarkidiornis melanotos	R	J
	36.	Cotton Teal	Nettapus coromandelianus	R	J
	37.	European Wigeon	Anas penelope	M	
	38.	Green Winged Teal	A. crecca	M	
	39.	Garganey	A. querquedula	M	
	40.	Mallard	A. platyrhynchos	M	
	41.	Spotbill Duck	A. poecilorhyncha	R	B
	42.	Northern Pintail	A. acuta	M	
	43.	Gadwall	A. strepera	M	
	44.	Northern Shoveller	A. clypeata	M	
	45.	Redcrested Pochard	Netta rufina	M	
	46.	Common Pochard	Aythya ferina	M	
	47.	Ferruginous Duck	A. nyroca	M	
	48.	Tufted Duck	A. fuligula	M	

Gruidae	49.	Common Crane	Grus grus	M	
	50.	Sarus Crane	G. antigone	R	B
	51.	Demoiselle Crane	Anthropoides virgo	M	
Rallidae	52.	Blue Breasted Banded Rail	Rallus striatus	R	
	53.	White Breasted Waterhen	Amaurornis phoenicurus	R	B
	54.	Moorhen	Gallinula chloropus	R	B
	55.	Purple Swamphen	Porphyrio porphyrio	R	B
	56.	Black Coot	Fulica atra	M	
Jacanidae	57.	Pheasant Tailed Jacana	Hydrophasianus chirurgus	R	B
	58.	Bronze Winged Jacana	Metopidius indicus	R	B
Rostratulidae	59.	Painted Snipe	Rostratula benghalensis	R	B
Recurvirostridae	60.	Black Winged Stilt	Himantopus himantopus	R	B
	61.	Pied Avocet	Recurvirostra avosetta	M	
Burhinidae	62.	Stone Curlew	Burhinus oedicnemus	R	
	63.	Great Stone Plover	Esacus recurvirostra	R	B
Glareolidae	64.	Little Pratincole	Glareola lactea	M	
Charadriidae	65.	Northern Lapwing	Vanellus vanellus	M	
	66.	River Lapwing	V. duvaucelli	R	
	67.	Yellow Wattled Lapwing	V. malabaricus	R	
	68.	White Tailed Plover	V. leucurus	M	
	69.	Red Wattled Lapwing	V. indicus	R	B
	70.	Pacific Golden Plover	Pluvialis fulva	M	
	71.	Ringed Plover	Charadrius hiaticula	M	
	72.	Little Ringed Plover	C. dubius	R	B
	73.	Kentish Plover	C. alexandrinus	M	
	74.	Lesser Sand Plover	C. mongolus	M	
Scolopacidae	75.	Black Tailed Godwit	Limosa limosa	M	
	76.	Bar Tailed Godwit	L. lapponica	M	
	77.	Western Curlew	Numenius arquata	M	
	78.	Spotted Redshank	Tringa erythropus	M	
	79.	Common Redshank	T. totanus	M	
	80.	Common Greenshank	T. nebularia	M	
	81.	Marsh Sandpiper	T. stagnatilis	M	
	82.	Green Sandpiper	T. ochropus	M	
	83.	Wood Sandpiper	T. glareola	M	
	84.	Common Sandpiper	Actitis hypoleucos	M	
	85.	Common Snipe	Gallinago gallinago	M	
	86.	Ruff	Philomachus pugnax	M	
	87.	Little Stint	Calidris minuta	M	
	88.	Temminck's Stint	C. temminckii	M	
	89.	Dunlin	C. alpina	M	
Laridae	90.	Great Black-Headed Gull	Larus ichthyaetus	M	
	91.	Indian Black-Headed Gull	L. brunnicephalus	M	
	92.	Black Headed Gull	L. ridibundus	M	
	93.	Whiskered Tern	Chlidonias hybrida	R	
	94.	Indian River Tern	Sterna aurantia	R	B
	95.	Black Bellied Tern	S. melanogaster	M	
Rynchopidae	96.	Indian Skimmer	Rynchops albicollis	M	

R - Resident, M - Migratory, B - Breeding, J - Juveniles seen.

Status of Mangroves in Maharashtra

S. B. Chaphekar and Sanjay Deshmukh***

I. Introduction

Maharashtra State has a 720 km long coastline that is divisible in roughly three types - hills with steep cliffs entering the sea, sandy beaches and mudflats. Shorelines of mixed nature are also found, e.g., rocky waterfronts and sandy beaches with interspersed rocks, mud-coloured sandy beaches, etc. According to the nature of the terrain, land-uses have been traditionally practised.

Different types of coastal areas are occupied by different types of organisms, both plants and animals. Rocky shores that are washed by tides are inhabited by marine algae - red, brown and green. A large number of molluscs, copepods and bivalves also inhabit the wet rocks. Sandy beaches harbour some algal species and an exceptionally wide diversity of animals - annelid worms, chanks and bivalves, star fish and urchins, sea anemones and sea cucumbers, etc. Sea grasses and corals are present on the lower side of intertidal zones while green algae and crabs inhabit the upper side of it. By far, the highest productive shoreline is the third type, i.e., the mudflats with their highly specialised vascular plants carrying out equally specialised functions of ecological significance. These plants are called mangroves.

II. Mangrove Forests

Mangroves are salt tolerant forest ecosystems in the tropical and sub-tropical intertidal regions of the world. These ecosystems are reservoirs of species of plants and animals, associated together over a long evolutionary time, and are still imperfectly known and not fully understood. Mangrove trees and shrubs dominate the habitat and provide an economic resource widely used by coastal people of the tropics for thousands of years.

During the course of evolution, mangroves have adapted themselves to the characteristic features of the habitat - seasonal fluctuations in salinity in estuaries and creeks and diurnal fluctuations in water levels caused by tidal movements at the lower parts of the plants. Uniformly dense foliage of plants, root systems specialised for anchorage in loose mud and breathing in spite of flooding, capturing litter in the network of roots, contributing to formation of excellent habitat for a variety of fauna that are looking for shelter and food, are important characteristics of mangroves. A large variety of fishes, prawns, molluscs, crabs, reptiles, birds, etc., use the mangrove habitat for deriving food and shelter. Deep sea fishes are known to use the habitat for breeding and rearing the juveniles in the food-rich and safe shelters of mangroves.

Zonation in Mangroves

Since the water situation and tidal forces operate at different intensities in different parts of an intertidal zone, the species of mangroves prospering in these areas are also different. Starting from the sea-side, one notices the following sequence of mangrove species while progressing towards land :

Rhizophora - Avicennia, Sonneratia, Aegiceras - Acanthus - Aeluropus

It is common to come across situations where the zonation pattern is disturbed due to different operative factors such as tidal forces, land features, human activities and differential sensitivities/ tolerances of different species to pollutants.

III. Mangroves of Maharashtra

In general, the number of plant species adapted to the demanding environmental conditions of intertidal zones, is limited. The mangrove flora of India comprises of about 97 species of both, exclusive and non-exclusive (salinity tolerant plants that are found growing along with mangroves towards the landward region of high tide level or above) mangroves. About 60 odd species of mangrove and associates belonging to 41 genera representing 29 families are observed along the coast of Maharashtra. A list of plant species exclusively observed in the intertidal regions of the coastal habitat of Maharashtra is given in Table 1.

Table 1 : Mangrove plant species growing in coastal habitats of Maharashtra along with their economic importance and appropriate position in the intertidal region. (Locality in the estuary is shown as D : Downstream; I : Intermediate; U : Upstream. Position in the intertidal region is shown as L : Low; M : Middle and H : High).

No.	Name of plant and family	Economic importance	Estuary location	Intertidal position
1.	*Acanthus ilicifolius* (Acanthaceae)	-	L, U	M, H
2.	*Acrostichum aureum* (Pteridaceae)	-	D, I	H
3.	*Aegiceras corniculatum* (Myrsinaceae)	Fuel	I, U	M
4.	*Aeluropus lagopoides* (Poaceae)	Fodder	U	H
5.	*Avicennia alba* (Verbenaceae)	Fuel	D	L, M
6.	*Avicennia marina* (Verbenaceae)	Fuel, fodder	D, I	L, M, H
7.	*Avicennia officinalis* (Avicenniaceae)	Fuel, fodder	I	L
8.	*Bruguiera cylindrica* (Rhizophoraceae)	Fuel	D, I	M
9.	*Bruguiera gymnorrhiza* (Rhizophoraceae)	Fuel	D, I	M, L
10.	*Bruguiera parviflora* (Rhizophoraceae)	Fuel	D, I	M, L
11.	*Ceriops tagal* (Rhizophoraceae)	Fuel	D, I	M, L
12.	*Clerodendron inerme* (Verbenaceae)	Hedges	I, U	M, H
13.	*Derris heterophylla* (Fabaceae)	-	I, U	M, H
14.	*Excoecaria agallocha* (Euphorbiaceae)	-	D, I	L, M
15.	*Kandelia candel* (Rhizophoraceae)	Fuel	D	L
16.	*Lumnitzera racemosa* (Combretaceae)	Fuel	D	M, H
17.	*Pandanus tectorius* (Pandanaceae)	Religious	U, I	H
18.	*Porteresia coarctata* (Poaceae)	Wild rice	D	L
19.	*Rhizophora apiculata* (Rhizophoraceae)	Fuel, tannin	I	M
20.	*Rhizophora mucronata* (Rhizophoraceae)	Fuel, tannin	I, D	M, L
21.	*Salvadora persica* (Salvadoraceae)	Fodder,oil	U	H
22.	*Salicornia bracheata* (Chenopodiaceae)	Food	U	H
23.	*Sesuvium protulacastrum* (Chenopodiaceae)	Food	U	H
24.	*Suaeda maritima* (Chenopodiaceae)	Food	U	H
25.	*Sonneratia alba* (Sonneratiaceae)	Fuel	D	L
26.	*Sonneratia apetala* (Sonneratiaceae)	Fuel	D	L, M
27.	*Sonneratia caseolaris* (Sonneratiaceae)	Fuel	D	M

Mangrove plants prosper along protected coastal areas. Though some mangroves are noticeable on open sea-fronts, abundant growth of these plants forming a continuous cover with their round canopies is seen along the banks of estuaries and creeks. Total area of mangroves is estimated to be 330 sq. km in

Maharashtra which is roughly 13 per cent of the total mangrove area in the country. Table 2 highlights the frequency (occurrence) of mangrove species (numbering 29) along shorelines of estuaries and creeks (totalling 59) in five districts of Maharashtra.

Table 2 : Occurrence (frequency) of mangrove species in five districts of Maharashtra.

Name of species	Thane	Mumbai	Raigad	Ratnagiri	Sindhudurg	Frequency (%)
Acanthus ilicifolius	p	p	p	p	p	100
Acrostichum aureum	a	a	p	p	p	60
Aegiceras corniculatum	p	p	p	p	p	100
Aeluropus logopoides	p	p	p	p	p	100
Avicennia alba	p	a	a	p	p	60
Avicennia marina	p	p	p	p	p	100
Avicennia officinalis	p	p	p	p	p	100
Bruguiera cylindrica	p	p	p	a	a	60
Bruguiera parviflora	a	a	a	a	p	20
Ceriops tagal	p	p	p	p	p	100
Clerodendron inerme	p	p	p	p	p	100
Derris heterophylla	p	p	p	p	p	100
Excoecaria agallocha	p	p	p	p	p	100
Kandelia candel	p	p	p	p	p	100
Lumnitzera racemosa	p	a	p	p	p	80
Pandanus tectorius	p	a	p	p	p	80
Porteresia coarctata	p	a	a	p	p	60
Rhizophora apiculata	p	a	p	p	p	80
Rhizophora mucronata	p	p	p	p	p	100
Salvadora persica	p	p	p	p	p	100
Salicornia brachiata	p	p	p	p	p	100
Sesuvium protulacastrum	p	p	p	p	a	80
Suaeda maritima	p	p	p	a	a	60
Sonneratia alba	p	p	p	p	p	100
Sonneratia apetala	p	p	p	p	p	100
Sonneratia caseolaris	a	a	a	p	a	20

a = absent p = present

IV. Fauna of Mangroves

A large number of animals is associated with coastal areas of Maharashtra. Some are very closely associated with mangroves, for a part of or their whole life. Some nest in mangrove canopy, some in the **strand** region. A large number dwell in mud-holes or at ground levels under bushes in "strand" vegetation. A large proportion of the species of animals are visitors to the region. Few methodical studies are available for the Maharashtra coastline, barring exceptions like "Birds of Mangroves at Ratnagiri" and "Avifauna and Fauna of Vikhroli Mangrove region" (Deshmukh, 1990). The latter contains a comprehensive list of birds numbering 147 species, consisting resident birds, seasonal, annual and casual migrants, etc. Twentythree species of fishes, eight species of prawns, 15 species of crabs, two coelenterates, annelid worm, four crustaceans, an in-

sect and 10 molluscs are among the other faunal elements recorded from the same mangrove area.

V. Plants in the "Strand" Region

In addition to the mangroves and their associate plant species growing in the intertidal region, a large number of plant species grow on land that is adjacent to that region. Though these plants from the neighbourhood terrestrial habitats belong to a variety of taxa, they have one common feature - they are tolerant of some amount of salinity of soil and salt sprays. Some of the mangrove and their associate species are also likely to be present in these habitats, where in general, trees are small in size, saturated scrub growth is ample and ground may be covered completely with grasses, sedges, etc. This vegetation is sometimes referred to as **"strand vegetation"**. A list of plants recorded as components of strand vegetation in coastal areas of Maharashtra in general and that of Mumbai in particular, is given in Table 3.

Table 3: List of plants constituting "strand" vegetation in coastal habitats of Maharashtra.

No.	Name of plant	Family	Life form
1.	*Abutilon indicum*	Malvaceae	Herb
2.	*Cleome viscosa*	Capparidaceae	Herb
3.	*Malachra capitata*	Malvaceae	Herb
4.	*Sida acuta*	Malvaceae	Herb
5.	*Typha angustifolia*	Typhaceae	Herb, Perennial
6.	*Thespesia populnea*	Malvaceae	Tree
7.	*Salmalia malabarica*	Bombacaceae	Tree
8.	*Melia azadarach*	Meliaceae	Tree
9.	*Zizyphus mauritiana*	Rhamnaceae	Tree/shrub
10.	*Aeschynomene indica*	Fabaceae	Herb
11.	*Derris heterophylla*	Fabaceae	Perennial climber
12.	*Derris pinnata*	Fabaceae	Tree
13.	*Gliricidia sepium*	Fabaceae	Tree
14.	*Tephrosia purpurea*	Fabaceae	Herb
15.	*Cassia siamea*	Caesalpiniaceae	Tree
16.	*Delonix regia*	Caesalpiniaceae	Tree
17.	*Parkinsonia aculeata*	Caesalpiniaceae	Tree
18.	*Peltophorum pterocarpus*	Momosaceae	Tree
19.	*Acacia auriculiformis*	Momosaceae	Tree
20.	*Pithecolobium dulce*	Momosaceae	Tree
21.	*Bruguiera cylindrica***	Rhizophoraceae	Tree
22.	*Sesuvium portulacastrum***	Aizoaceae	Herb, Perennial
23.	*Salvadora persica***	Salvadoraceae	Tree/shrub
24.	*Ipomoea carnea*	Convolvulaceae	Shrub
25.	*Hygrophilla auriculata*	Acanthaceae	Herb, Perennial
26.	*Clerodendrum inerme* **	Verbenaceae	Shrub
27.	*Avicennia officinalis***	Avicenniaceae	Tree
28.	*Lantana camara*	Verbenaceae	Shrub
29.	*Hyptis suaveloens*	Labiatae	Herb

30.	*Boerhaavia difusa*	Nyctagenaceae	Herb, Perennial
31.	*Alternanthera sessilis*	Amaranthaceae	Herb, Perennial
32.	*Jaatropa curcas*	Euphorbiaceae	Shrub
33.	*Ricinus communis*	Euphorbiaceae	Shrub
34.	*Trema orientalis*	Urticaceae	Tree
35.	*Ficus hispida*	Moraceae	Shrub
36.	*Casurina equisitifolia*	Casurinaceae	Tree

Note : In addition, a large number of grasses, cyperaceae plants and monsoon annuals are also reported, but not listed here. ** : Mangroves and / or their associates.

V. Conclusion

Mangrove ecosystem forms an important component of the coastal biome in the tropics. This ecosystem occupies about 330 sq km area in Maharashtra and forms about 13 per cent of the total mangrove area in the country. Due to its high productivity, the ecosystem supports a large diversity of faunal elements in addition to flora, which receive food and shelter from mangroves. The system also forms a protective cover on ground that is prone to erosion due to wave action and winds. Strand vegetation growing in areas adjacent to mangroves above the high tide level supports a wide variety of salt tolerant plants and provides habitat for a wide variety of fauna.

Unfortunately, though a number of studies have been carried out on mangroves to understand their form, structure and functional aspects, there are numerous gaps in the data, especially in relation to the distribution of floral and faunal elements in different places, and along different creeks and estuaries in the state. Information on fauna is still very scanty. Intensive studies are needed for filling these gaps in our knowledge in this important subject.

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Medical Resources in Tribal Cultures

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Introduction

Upliftment of the poor and needy, the down-trodden, the victims of dreadful diseases and natural calamities such as Aids, Cancer, earthquakes, floods, famines, etc.; the victims of social circumstances such as the destitutes, orphans, drug addicts, juvenile delinquents, child labourers, alcoholics, prostitutes and dev dasis, etc. has been one of the major concerns of both government and non-government social service and relief agencies the world over.

With changing times, the strategies and approaches to develop the needy are also changing. As rightly stated by Mathur H. M. (1990 : vi) planners and administrators have begun to realize that people are the prime concern of social intervention and hence many people-centred programmes are being undertaken.

However, the people-centred approach presupposes a first-hand knowledge of the people concerned.

Unless due recognition is given to understand the life style of the beneficiaries, their culture, customs, traditions and social practices, their needs of development as perceived by them, the natural and human resources prevalent in their eco-cultural systems, the developmental programmes planned and implemented for them will not be able to produce the results desired. Recognizing the value of social and medical science research, developmental agencies have recently started looking to both social and medical scientists for their assistance in planning, implementing and evaluation of health care and health educational programmes for the people concerned. Today, a number of government and non-government organizations are working out health care and health educational strategies for the tribals the world over. However, very few agencies have made an attempt to take stock of the potential of both natural and human medical resources in the tribal eco-cultural systems. A Chinese proverb makes the approach of development very clear. "It advocates developmental agencies to build on what people have". Very often, voluntary agencies, scholars, planners and even government agencies try to impose their ideas of development without letting people participate in planning, implementing and evaluation of development programmes. Hence they land up in problems such as non-participation and non-cooperation from people, failures in planned programmes and so on. It is therefore, necessary to identify what people have and then work with people to build on what they have.

This paper presents a plan for development of both natural and human medical resources which exist in tribal eco-cultural systems. It also highlights the significance and the need for developing this aspect of tribal health care which has been a part and parcel of their ethnomedical systems since times immemorial.

Tribals in India

India has the largest number of tribal population in the world only next to Africa. They are known by many names such as adivasis (original inhabitants), vanyajati (castes of the forest), pahari (hill dwellers),

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anusuchit jati (scheduled tribes) and so on. According to Anthropological Survey of India, these are nearly 3/4 scheduled tribes in India geographically distributed in 21 states and 4 union territories, with a population of 6.78 crores amounting to 8.0% of the country's total population in the 1991 census. In Maharashtra there are 47 scheduled tribal communities, with a population of 73.18 lakh which is 9.27% of the total population of the state according to 1991 census.

It has been estimated that the tribal areas constitute about 15% of the total geographical area of the country. Majority of the tribals in India have been living in remote and inaccessible areas in thick forests, on hill slopes, in valleys and even on plains. This natural and social isolation has deprived them of being part of the scientific and technological programmes which are the development objectives of the main stream population.

Most tribals in India are small scale cultivators, agricultural labourers, daily wage labourers, food and minor forest produce gatherers, hunters and occasional fishermen. Landlords, forest contractors, traders and money-lenders exploit the tribals in various ways. This kind of exploitation and deprivation of the tribals have cut them off from the main stream of socio-economic development of the country as a whole. It was for this very reason that government and non-governmenal agencies are working for the social and economic upliftment of the tribals in various ways. Tapping both natural and human resources and developing them for the benefit of the tribals has been one of the strategies adopted by a very few organizations.

It is in the light of this strategy of identifying and developing natural and human medical resources in tribal eco-cultural systems, the views in this paper are put forth. The paper will hopefully be useful to both voluntary and governmental agencies working for the development of tribals and more particularly in the field of health care, health education and nutritional care.

Medical Resources in Tribal Eco-cultural Systems

Forests and other natural surroundings in which the tribals lived since times immemorial, have played an important role in their lives. Tribals depend on forests for their economic livelihood. Trees, shrubs, flowers, seeds, stems, shoots, fruits, etc. are not only used as food and medicinal items but are also used in various rituals of their social and religious life. Forests are hence an integral part of their social, religious and economic life.

Based on studies by Medical Anthropologists, Ethnobotanists, Pharmacologists, Biochemists, Economic Botanists and other social and medical scientists, tribal medical resources can be classified as follows :

1. Natural Medical Resources
2. Human Medical Resources.

Natural medical resources are those sources of medicine such as medicinal herbs, minerals, medicinal extracts from bird and animal sources, medicinal mud, healing stones, hot springs, metals, water etc. used to cure a disease and illness or even used in healing rituals as medical symbols and which are found within the ecosystem wherein a tribe or community dwells.

On the other hand human medical resources refer to the knowledge, skills, practices and the potential involved therein of traditional medical practitioners such as bone setters, herbalists, mid wives, shamans, priests and other personnel who are directly or indirectly linked with preventive, promotive and curative health of their community and other social groups as well.

1. Natural Medical Resources

Data on the ethnomedical studies on the Thakurs, Warlis, Katkaris, Bhils, Korkus and Mavchis of Maharashtra show the use of following natural medical resources for healing purposes (Tribhuwan Robin, 1993; Tribhuwan Robin and others, 1993; Kurian J. C. and Tribhuwan Robin, 1990; Tribhuwan Robin and Peters Preeti, 1992; Tribhuwan Robin and Gambhir R. D., 1995)

a) Medicinal herbs
b) Medicines extracted from animal and bird sources.
c) Medicated mud
d) Use of water, minerals and metals.

Table 1 : Medicinal Herbs

S. No.	Disease	Local name of Herb	Botanical Name	Part Used	Administration
1.	Scabies	Karanji	Pongamia pinnata	Oil of seed	Oil is applied twice a day
2.	Cough	Hirda	Terminalia chebula	Fruit	Fruit chewed 2/3 times a day
3.	Stomach ache	Nimbara	Melia azadirachta	Leaves	1 cup decoction from the leaves taken in the morning
4.	Swellings	Rui	Calotropis gigantia	Leaf	After dipping in hot water, leaf tied on a swollen part
5.	Sprains	Nirgudi	Vitex negundo	Leaves	Leaves heated in a pan and tied on the swollen part
6.	Tooth decay	Bhui ringani	Solanum kanthocarpum	Fruit	Fruits put on charcoal smoke inhaled through the mouth
7.	Chapped heels	Biba	Semicarpus anacardium	Seed	Seed fluid mixed with ground nut oil is applied on affected areas
8.	Migraine	Biba	Semicarpus anacardium	Seed	Seed fluid applied on the affected part of the forehead
9.	Snake Bite	Karvanda	Carissa carandus	Root	Root chewed and extract swallowed. Chewed root also applied on the bite
10.	Stomach ache	Medh shing	Helictrus Ixora	Fruit	Powdered fruit in a glass of water taken twice a day
11.	Cough	Gunj	Abrus precatorius	Leaves	Fresh leaves of Abrus precatorius are chewed
12.	Chicken pox	Umber	Ficus glomerata	Sap	Sap of root collected overnight in a pot is given to patient
13.	Burns, cuts, wounds	Sag	Tectona grandis	Leaves	Ash of Tectona leaves is mixed with chicken fat oil and applied on cuts, wounds and burns
14.	Kidney stone	Palash	Butea frondosa	Flowers	Flowers of Butea frondosa are heated and tied on the belly of a patient suffering from kidney stone
15.	Dysentry	Jambhul	Syzygium cumini	Bark	1-2 spoons of powdered bark is mixed with water and taken twice a day
16.	Scabies	Limb	Azadirachta indica	Leaves	Paste prepared from neem leaves is applied externally
17.	Dysentry/ diarrhoea	Kuda	Hollarehna antidysenterica	Bark	A teaspoon of powder prepared from the dry bark of kuda is mixed in a glass of water and taken twice a day.
18.	Pimples	Savar	Salmalia malbaricum	Thorns	Powder of thorn mixed with groundnut oil is applied on pimples
19.	Menstrual disorders	—	Woodfordia floribunda	Flower	Dried flowers are ground and taken with milk
20.	Mumps	Umber and Nagli	Ficus glomerata and Eleusine coracana	Latex and Grains	Latex applied to the swelling and some powder of Nagli grains stuck on it

Table 2 : Animals as Sources of Medicines

S. No.	Name of Animal	Local name	Bodily part used	Disease and Aministration
1.	Monitor lizard	Ghorpad	Fat	Oil extracted from fat of monitor lizard is used as a massage remedy for joint pains
2.	Mongoose	Mungus	Hair	Hair of mongoose are burnt and its ash is mixed with a teaspoon of jaggery syrup and taken twice a day as a remedy for asthama
3.	Bat	Vatwaghul	Entire body	Entire body of the bat is cleaned, boiled and cooled. The thick fatty precipitate or layer which is formed as a result of cooling is mixed in a glass of water and taken twice a day as remedy for asthama
4.	Hen	Kombdi	Anus	Oil extracted from the anus of the hen is used as a remedy for burns, cuts and wounds
5.	Tortoise	Kasav	Head	Head of a tortoise is rubbed on a stone using some water. This water is collected in a glass. The patient is given two spoons of this water as a remedy for bloody stools.
6.	Goat	Bakri	Milk	Goat's milk is used as a remedy for sore eyes
7.	Bandikoot	Ghoos	Entire body	Meat of bandikoot is consumed as a remedy for T.B. and arthritis
8.	Peacock	More	Claw	Claws of peacock are boiled in groundnut or coconut oil. This decoction is filtered. A drop or two of the filtered oil is used as a remedy for earache.
9.	Deer	Sambar	Horn	Horn powder, with alum and water is made into paste. This paste is applied on swellings and joint pains.
10.	Cow/Bull	Guy/Bail	Horn	Horn ash mixed in pongamia pinnata oil is a good remedy for piles. It is applied externally.
11.	Wild dove	Kavda	Meat	Meat is consumed as a remedy for arthritis
12.	Fox	Kolha	Skin	A cap made from the skin of the fox with fur is worn by a paralytic patient for cure
13.	Cat	Manjar	Teeth	Powder of cat's teeth is mixed with pongamia pinnata oil and applied
14.	Wild boar	Randukkar	Fat oil	Fat oil of wild boar is used to massage joint pains
15.	Bat	Watwaghul	Fat oil	Fat oil of the bat is massaged on affected body parts of paralytic patients
16.	Green pigeon		Harail	Blood Blood of green pigeons is applied over affected parts of paralytic patients
17.	Crane	Sarus	Meat	Meat of black feathered crane is consumed as a remedy for joint pains
18.	Tiger	Wagh	Claw	Nail of a tiger's claw is worn to ward off evil effects of spirits and forces

(We do not advocate the adoption of these remedies — Ed.)

c) Use of Mud for Healing Purposes

The reference of the use of clay or mud is given in Ayurveda and Naturopathy. In fact, mud therapy is one of the important treatment methods used by naturopaths. Use of mud for healing purposes is certainly prevalent in tribal medical systems, however, this area needs to be researched in detail. Among the Thakur of Karjat mud under the pot is used as a remedy for wasp stings. Similarly mud from anthill is kept under the neck of a woman whose delivery gets delayed. A cross cultural study or survey of the medicinal use of mud in tribal and rural societies should be undertaken. Samples of mud should also be collected and analyzed by medical personnel and scientists so as to assess the medicinal properties of mud.

d) Use of Water, Minerals and Metals

It has been observed that hot and cold water is used by the tribals to cure diseases. For example cold water packs are put on a patient's forehead as a remedy for fever. Hot water is used as a remedy for joint pains, muscle pulls, swellings, etc. Hot water with neem leaves is a good remedy for scabies. Different tribes may have different usage of water for healing purposes. Similarly minerals like ash, semi precious stones, hot springs (sulphur water) are also observed to be used by the tribal and rural folks of India. A scientific analysis of little known and unknown minerals, metals and even use of water for preventive, curative and promotive health should be documented and researched on.

e) Discovering the Nutritive Value of Foods and Minor Forest Produce : Items Consumed by the Tribals

Several studies have been conducted on the calorie intake by the tribals and nutritional disorders that are prevalent among tribal women and children. However, very few studies are available on the identification of nutritive foods consumed by the tribals.

For instance, Vilasrao Salunkhe, a noted social worker studying the Kolam tribe in Yavatmal district to promote watershed management techniques and mobilization of minor forest produce, reports upon the nutritive value of Mauha flowers (Madhuca indica). He noticed that the Kolams consumed these flowers either by boiling them or heating them on a pan. Flowers would be consumed in the morning and whole day they would not eat anything. He enquired out of curiosity to find out whether they feel hungry or not. They responded positively and said they did not feel hungry at all, till the time of dinner in the evening.

Mr. Vilasrao Salunkhe then reviewed the chemical properties of "Mauha" flowers with the help of experts and found that it contains 4% protein and 80% sugar along with important vitamins like Vitamin C and minerals like iron. These flowers are rich in caloric contents giving 350 cal/100 gms. which is quite high as compared with that of milk which is 65 cal/100 gms. He blended these flowers with til seeds (sesamum sp.) which improved the nutritional value of the preparation and also contributed in masking the bitter taste of mauha flowers. Thus Mr. Salunkhe used the indigenous resources for creating a nutritional food supplement which the local people can easily afford. This combination will certainly play an important role in preventing and treating protein-calorie malnutrition which is very common in tribal areas.

Tribals who live in thick forests, on hills and in valleys depend more on edible roots, fruits, tubers, corms, vegetables, etc. than the tribals of the plains. For instance the Angami Nagas of Nagaland consume a number of the above mentioned plant products. Given below is a table highlighting the edible plant parts and products (Baishya B, 1995).

Table 3 : Wild Edible Plants Consumed by Angami Nagas

S.No.	Botanical Name	Part used	Method of Consumption
1.	Alocasia indica	Corm	Boiled and eaten
2.	Alpinia galanga	Rhizome	Soup prepared from rhizome is consumed
3.	Alocasia macrorrhiza	Corm	Boiled and eaten
4.	Alpinia speciosa	Rhizome	Boiled and eaten
5.	Amorphophallus companulatus	Corm	Solid, fleshy corm is boiled and eaten

6.	Asparagus racemosus	Root	Eaten raw as well as boiled
7.	Colocassia esculanta	Corm	Boiled and consumed
8.	Curouma zodoaria	Rhizome	Boiled and eaten
9.	Dioscorea bulbifera	Corm	Boiled and eaten
10.	Dioscorea hispida	Corm	Boiled and eaten
11.	Dioscorea pentaphylla	Corm	Boiled and eaten
12.	Dioscorea alata	Corm	Boiled and eaten
13.	Dioscorea aculenta	Corm	Boiled and eaten
14.	Houttuynda cordata	Tuberous roots	Tuberous roots eaten raw as well as boiled
15.	Ipomoea batatas	Root	Eaten raw as well as boiled
16.	Typhomium trilobatum	Corm	Boiled and eaten
17.	Zingibar cossumenar	Rhizome	Consumed as vegetable
18.	Amaranthus spinosus	Leaves	Boiled and eaten
19.	Bambusa tulda	Shoots	Cooked in the form of curry and pickled as well
20.	Moringa oliefera	Flowers	Cooked as vegetables
21.	Artocarpus heterophyllus	Seeds	Roasted and eaten
22.	Solanum indicum	Greenpods	Fruit eaten cooked and raw
23.	Solanum allophyllum	Leaves	Eaten as salad with dry fish
24.	Dellinia indica	Flowers	Boiled and eaten
25.	Nelumbo nucifera	Buds	Boiled and eaten

An analysis of the above plants and many of such plants used by tribals should be made in order to develop and give the best of what is available.

Mobilization of Human Medical Resources

When illness or diseases strike the tribals either ignore it or treat it at home using home remedies or refer it to a medical specialist such as herbalists, shamans, diviners, bone setters, masseurs, priests and midwives. These traditional practitioners have been providing health care services to their community members and even other social groups since times immemorial. A therapist may be specialized in one type of skill or may combine several in one (Lieban, 1962). All these specialists are looked upon with great respect by the members of their community.

Qualifications for folk medical roles vary considerably. In some cases formal training is required for the practitioners (Metzger and Williams, 1963), in others a long apprenticeship may be customary. A post of a medical practitioner is hereditary, i.e. medical knowledge of a specialist is restricted to a particular clan or family in the community. Before getting into the discussion on mobilizing human medical resources, let us understand the common types of medical specialists prevalent in tribal cultures.

Types of Ethnomedical Specialists

Every therapist has a specific role and function to play in the healing process. Literature on ethnomedical specialists mentions the following categories of practitioners.

1) Shamans : A shaman according to Michael Harner (1973 : ix) is a man or woman who is in direct contact with the spiritual world through a trance state and has one or more spirits at his/her command to carry out his/her biddings for good or to cure persons affected by spirits of other shamans.

Shamans among the tribes of Maharashtra are known by different names such as Bhagats or Bhagatins among the Thakurs, Katkaris, Koknas, Warlis, Mahadeo Kolis, Dhor Kolis; Budwas and

Budwis among the Bhils; Parihars or Padiyals among the Korkus and so on. The major medical functions of shamans are :

a) Diagnosis and interpretation of the cause of illness, using diagnostic rituals.
b) Presiding over healing rituals.
c) Providing both physical and psychological relief to the patients.
d) Warding off evil effects, forces and beings which are harmful to human health.
e) Performing preventive and promotive health rituals etc.

Much of shamanistic behaviour is linked with superstitions, ignorance, illiteracy if one looks at it negatively. But if it has to be developed one has to study the positive side of shamanistic cult and assess it scientifically. A number of shamans, in fact all of them use medicinal herbs, medicated minerals, extracts of medicines from animal sources and certain healing objects used by them have proved to be very effective. It is necessary to first study this knowledge and then with expert help scientifically analyze the properties of medicines used by them.

2) Priests : A priest on the other hand is a religious functionary whose supernatural authority is bestowed upon him by a cult or an organization. In contrast to a shaman he derives his powers directly from supernatural sources (Hoebel, 1958). In most tribal societies priests play an important role in healing. For instance, the "bhoomka baba" (priest) among the korku tribe of Melghat region also treats patients to fulfil his medical duties. He has knowledge of medicinal herbs.

3) Bone setters : They are specialized practitioners who provide treatment for mechanical injuries such as sprains, swellings, fractures. They too use medicinal herbs, medicated oils, medicated fats and other mechanical means to set broken bones (Kurian J. C. and Tribhuwan Robin, 1990). Bone setters among the Thakurs are known as "Had vaidus" and among the Korkus as "Had Gurus". They have knowledge about the position of bones, nerves, veins and arteries in human body.

4) Mid wives : According to Mary Schutler (1979), a midwife is one who is always a female and necessarily not a diviner. Her duties are to give advice and medical aid to expectant mothers, to assist in deliveries and to treat illness that may befall the new mother and child. To fulfil her duties a midwife prescribes a few herbal medicines, knows massage techniques and recommends proper diet for the new mother and child. Midwives are popularly known as Suines, Dais and Huvarkis among the tribals in Maharashtra.

5) Male Dais : Contrary to Mary Schutler's views about midwives necessarily being females in Dhule district, Maharashtra State, among the Bhils of akkalkuwa, Akrani and Shahada we come across males performing the role of midwives. Male Dais (men) conduct deliveries in the above mentioned tribal tehsils of Dhule district.

6) Assistant Midwives : Among the tribals of Karjat tehsil in Raigad district we find potdhars assistant midwives who assist the Suines (midwives) in conducting deliveries. Later the potdhars take up the responsibilities as Suines.

7) Herbalists : A herbalist is one who does not use magico-religious elements like the bhagats. He uses only/mostly medicinal herbs to cure his patients. He also advises his patients on diet to be taken during ill-health. Herbalists are popularly known as vaidus.

8) Herbalists specializing in Scorpion Sting and Snake bite : Among the Thakurs of Karjat there are "Mantriks", who are specialized herbalists in curing snake bites and scorpion stings using herbal and magico-ritualistic therapies (Tribhuwan Robin, 1993).

9) Masseurs : In some tribal communities we find masseurs also who are specialized only in massage techniques.

Not every tribal society may have all these different types of medical practitioners. They may be located in different villages in a tehsil or district whose services the tribals may avail of. Studies on ethnomedicine show that these tribal medical practitioners are reluctant to reveal their medical secrets as they are restricted to a family or a clan and are linked with their status as knowledgeable medical personnel. In such situations close rapport with these personnel is very necessary.

Voluntary organizations such as the Academy of Development Science in Karjat, district Raigad and Integrated Child Survival project in Navapur, Dhule district in Maharashtra have proved that it is possible to develop a close rapport with these practitioners, understand their medical practices, the medicines they use and their medical potential. After having understood the nature and role of traditional practitioners these organizations have started training programmes for herbalists, bone setters and midwives so as to build on what they have and give their system of medicine a scientific direction. They have however, not started their work on shamans. Nevertheless, this kind of work should set an example for other voluntary and governmental organizations to take up training and research programmes to develop the human medical resources prevalent in tribal cultures.

10) Knowledgeable Elderly Folks : Besides the above common categories of medical specialists, one finds that elders both men and women in tribal societies have good knowledge of medicinal herbs, minerals, metals and medical sources of animal origin. These elders make use of their medical knowledge to treat their family members using home remedies of varied kinds.

Therapies and Medical Skills in Tribal Medicine

Therapy in ethnomedicine, states Lieban (1973 : 1045) is a vast subject that includes both magico-religious, mechanical and herbal (chemo) therapeutic procedures. An assessment of indigenous medical systems, including those of non-literate societies, shows an impressive array of practices that demonstrate empirical therapeutic knowledge, including trephining, bone setting, removal of ovaries, obstetrics including caesarean section, laparatemy, uvulectomy, comparative anatomy, autopsy, cautery, inoculation, baths, poultices, inhalations, laxatives, enemas, ointments and cupping (Laughlin, 1963; Ackerknecht, 1942; Simons, 1955 and Haurd, 1969).

A study by Laughlin (1963), on the Eskimo-Aleut groups of the Arctic revealed following medical skills suturing, removal of stone points, amputation, ligation, opening of the abdominal cavity, acupuncture, including both the use of fixed points of those determined by individual cause, blood letting, delivery of malposed foetuses, breach deliveries, massage applied commonly and rigorously — the use of herbal hot packs, sometimes in the sweat bath and use of a variety of herbals.

The pharmacopoeia of ethnomedicine no doubt presents an array of scientific practices which are prevalent in tribal and rural societies. Health care providers, health policy makers and planners must encourage pharmacologists, biochemists, ethnobotanists, anthropologists and others to take up studies to identify the natural and human medical resources and their potential so as to uplift it for the benefit of the tribals. It would be appropriate at this juncture to raise the issue of superstitious beliefs and practices which are an integral part of tribal medical systems. Efforts should be made to gradually remove these practices or ignore them and promote the scientific aspects of tribal medicine. It is a difficult task. However, if this concept of development of human and natural medical resources is approached or worked upon positively with interest, determination and dedication, it would certainly produce fruitful results.

Role of Pharmacologists, Biochemists, Ethnobotanists in Drug Research/Development

At present about half the world's population resides in countries which have ministries or departments of traditional medicine and in many countries 80% or more of the population living in rural and tribal areas are cared for by traditional health practitioners and birth attendants (Bannerman and others, 1983).

In India nearly 70% of the population resides in rural and tribal areas wherein a pluralistic variety of practitioners take care of the sick in the community. Documentation of their medical knowledge and skills has no doubt been an ongoing process for the last couple of decades. However, it is necessary to put in more efforts on promoting drug research, identifying and uplifting the less known and unknown natural medical resources in rural and tribal medical systems which have a scientific base.

Success of Indigenous Medicine

There have been a number of spectacular successes with herbal medicines. The most notable was the emergence of "qinghaosu" from Chinese herbal medicine, as an important new antimalarial drug. In Wales, a small part of United Kingdom, Feverfew leaves have been demonstrated to be an effective treatment for migraine and tabletted leaf is now being sold for this purpose, a reminder of days not long gone when Digitalis leaf pill was used to treat heart failure.

It has been proved that a significant number of synthetic drugs have unacceptable side effects, particularly widespread are those of the non steroidal anti-inflammatory drugs (NSAIDS) which all cause damage and bleeding of the gastric mucosa. Secondly, the very high cost of allopathic drugs developed and exported (or licensed) from the developed countries means that they can never be available on a scale which will allow effective treatment of diseases in developing countries (Patwardhan B. and Hooper M., 1991 : 2).

As rightly pointed by Bannerman and others (1983 : 328) herbal medicines have proved to be effective, safe and culturally acceptable and that the rural and tribal folk find it difficult to purchase allopathic drugs due to high cost. It is therefore, necessary to explore the hidden secrets of the medico-ethnobiological knowledge of the rural and tribal medical systems, so as to scientifically build on what is available.

Concluding Remarks

Folk medicine has an intrinsic utility. It should, therefore, be scientifically evaluated, promoted and given due recognition to improve its efficacy, safety, availability and wider applicability at low cost.

In closing we would like to make a few suggestions which will help both voluntary and governmental organizations.

1) Detailed documentation and scientific recording of natural medical resources such as herbal medicines, medical extracts from animal sources, medicated metals, minerals, mud, water, etc. used by the rural and tribal folks be identified and researched upon to assess their scientific base.

2) Pharmocologists, Ayurvedic physicians, Biochemists, Pharmaceutical manufacturers, Anthropologists, Allopaths, Ethnobotanists and other medical scientists must work unitedly with the traditional practitioners to give folk medicine a scientific and commercial base without disturbing their cultural values associated with folk medicine. Such a team can contribute to planning and setting up local pharmaceutical units managed by the tribals and rural folks themselves with the guidance of the medical team. This will not only provide employment to the tribals but also be a source of income for them. Care, however, has to be taken by medical experts to supervise the manufacturing process and also assist the tribals in marketing the finished goods. The Academy of Development Science is an excellent example which has proved that if an organization works closely with traditional practitioners it would be possible to identify, mobilize and develop natural and medical resources of the tribals. To a certain extent that can even start a small pharmaceutical unit to manufacture medicines.

3) Identification human resources such as shamans, bone setters, midwives, herbalists, masseurs, elderly folks who provide health care to the sick in their community should be done very urgently because these practitioners do not easily reveal their medical knowledge which dies with them if they cannot transmit it to their sons or relatives in the family. Such medical personnel should be approached in such a way that their profession gets a scientific and commercial turn. Infact, if small pharmaceutical units have to be started in tribal areas these folks can work as employees and get benefitted.

4) The various therapies and treatment procedures and skills in folk medicine should be evaluated.

5) Foods which are of nutritive value should be identified and efforts should be made to come out with new nutritional supplements which would be culturally acceptable to the tribal folks. Furthermore, nutritive foods such as Eleusine coracana (Nagli), Dioscorea indica (Kanda), Ficus religiosa (Peepal Leaves), are widely consumed by tribes such as Thakurs, Katkaris, Mahadeo Kolis of Karjat, Korkus and Gens of Malghat and others too. Production of these foods should be encouraged.

6) Cultivation of medicinal and nutritional plants by involving traditional panchayat members, leaders, medical practitioners, youth and mahila mandals, drama and dance parties, school teachers and children should be encouraged.

7) The tribals and rural folks should be encouraged to take up nutritional garden or kitchen garden schemes to be managed by themselves.

8) Communicational and educational strategies for the tribals to promote and propagate the significance of development and mobilization of natural and human medical resources should be designed keeping in view the ill-effects of deforestation and killing of wild animals. It is necessary to mention at this juncture that a number of tribal groups are using animal extracted medicines. This raises the issue of protection of wild life. We are only suggesting in this paper that the science behind these medicines extracted from animal sources must be assessed and if possible mobilized. This does not mean that we are encouraging destruction of wild life.

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Birds of Agaratoli, Kaziranga

Mann Barua

Abstract

This article is written with two objectives in mind (i) to prepare a list of the birds in Agaratoli because no such list has been prepared before and (ii) to report about a few uncommon birds found in Agaratoli with some of the details I observed during my trips. In this connection, the location of Agaratoli, its habitat, the problems which affect this area, arising out of social and natural conditions, are mentioned.

Introduction

Kaziranga National Park is perhaps one of the best places in India to see wildlife. Kaziranga covers an area of 436 km^2 and is divided into three ranges — Baguri, Kohora and Agaratoli.

Comparatively very few tourists visit Agaratoli range. This is probably because it is far from the main visiting area and, sightings of large mammals are few there. From the birdwatcher's point of view, however, Agaratoli is decidedly the best because the birdlife there is richer than the other ranges of the park.

Because of the diverse habitat the birdlife is varied. This undisturbed area protects many endangered species. These include the Bengal florican *Houbaropsis bengalensis* and the Greater adjutant stork *Leptoptilus dubius*.

Study Area

The Agaratoli range (Fig. 1) is situated in the Golaghat district of Assam. Agaratoli covers an area of about 80 km^2 (20% of Kaziranga) and is the smallest range in the park. The altitude is about 44 metres above the sea level and the average temperature is 8°C min. and 34°C max. The nearest town is Bokakhat, which is about 3 km from Agaratoli.

The area has four distinct habitats — woodlands, grasslands, wetlands and sandy islands. The moist deciduous woodlands are dominated by Cane *Calamus* spp. in the understorey. *Albizzia procera, Bombax ceiba, Lagerstroemia flos reginae, Lagerstroemia speciosa, Trewia nudiflora* and *Dillenia indica* are the common trees in these woodlands (Sharma pers. comm.).

The riverine grasslands cover about 35% of the area. The species of grass found in these grasslands are *Imperata cylindrica, Erianthus ravennae, Arundo donax, Saccharum spontaneum, Saccharum elephantus, Phragmites karka, Polinia ciliata, Cynodon dactylon* and *Hemarthia compressa* (Sharma pers. com.). Some trees like *Zizyphus* spp., *Albizzia procera* and *Bombax ceiba* are scattered in these grasslands. These grasslands are burnt every year to stop the woodland from spreading. This burning affects a lot of birds and lesser mammals as well.

The area abounds in wetlands or 'beels'. The water surface of these wetlands is usually dominated by water-hyacinth *Eichhornia sp.* These wetlands are usually shallow and water depth does not exceed 6 feet. In winter the water-level decreases. Plants such as *Andropogon sp., Ipomoea raptans, Enhydra fluctans, Pistia strafiotis* and *Leima panicostella* grow on the fringes of such wetlands (Sharma pers. comm.).

Another habitat is the sandy 'Chaporis' (river isles) of the Brahmaputra. These 'Chaporis' are dominated by a pine-like 'jhau' shrub *Tamarix dioica*.

The area is threatened by a number of factors. Rhino poaching is by far the most penetrating threat.

Other problems are livestock grazing, excessive growth of vegetation and siltation. The summer floods in Kaziranga are a natural source of clearance of

vegetation. But since 1991 the floods have not been big enough to clear all the vegetation. Illegal fishing takes place once in a while.

Birdwatching

About 280 species of birds have been recorded in Agaratoli. 272 species have been seen by me (Appendix 1) and the additional 9 species by others (Appendix 2).

The list has been compiled from about 110 field trips from 1992 to 1995. Most of the field trips were made during winter (Oct.-Apr.) and very few during summer (May-Sept.). During these summer trips birds like the Pied crested cuckoo *Oxylophus jacobinus*, Stone curlew *Burhinus oedicnemus* and the Black bittern *Ixobrychus flavicollis* have been observed. These birds have not been seen during winter.

The winter migrants arrive by Oct./Nov. and are gone by Apr./May. Sohola, the largest wetland in the area is a home for 2000+ wintering waterfowl. This includes 600+ Barheaded goose *Anser indicus*, 200 Greylag goose *Anser anser* and 200 Pintail *Anas acuta*. Waterbirds are seen in the other wetlands of this range, but in smaller numbers.

On 14th January 1994 while watching birds in the Rongamotia beel my attention was drawn by four Falcated teal *Anas falcata*. After some time I noticed two 'brown teals'. On closer observation I could see the following markings — yellow bill, overall colour pale brown, mottled with a paler shade; size of that of the Common teal *Anas crecca*; a dark patch on the eye. They were identified as the Marbled teal *Marmaronetta angustirostris*. This rare bird was recorded in Assam after a long interval.

There was a large colony of the threatened Spottedbilled pelican *Pelecanus phillippensis* in a place that has been named 'Pelican kathoni'. The colony used to consist of 375 nests but due to some unknown reason their number has decreased to ten.

The following are some interesting observations made in Agaratoli :

001. Spottedbilled pelican *Pelecanus phillippensis*, nesting in Pelican kathoni.
002. Darter *Anhinga melanogaster*, groups of 30+ have been observed in Sohola and Rongamotia beels.
003. Greater adjutant stork *Leptoptilus dubius*, seen frequently in Sohola and Rongamotia beels.
004. Lesser adjutant stork *Leptoptilus javanicus*, common in most wetlands.
005. Marbled teal *Marmaronetta angustirostris*, seen in Rongamotia beel on 12th January 1994.
006. Falcated teal *Anas falcata*, four were seen in Rongamotia beel on 12th January 1994, and two in Belipora beel on 31st January 1995.
007. Chinese spotbill *Anas poecilorhyncha zonorhyncha*, common in most wetlands. According to Ali and Ripley (1983) it is a frequent straggler to Assam.
008. White-eyed pochard *Aythya nyroca*, a common winter visitor.
009. Goshawk *Accipiter gentilis*, one bird was seen in Sohola kathoni in February 1994. Uncommon winter visitor to Assam.
010. Pallas's fishing-eagle *Haliaeetus leucoryphus*, nesting in Sohola kathoni.
011. Greyheaded fishing-eagle *Ichthyophaga ichthyaetus*, nesting in Sohola kathoni.
012. Cinereous vulture *Aegipius monachus*, one was seen near Turturani camp on 29 December 1994. This is a fairly low altitude for this bird.
013. Striped harrier *Circus spilonotus*, one bird was seen in Pelican kathoni on 16 December 1993. The first record for Kaziranga.
014. Hen harrier *Circus cyaneus*, one bird was seen outside the park on 11th November 1993, and two in Sohola beel on 31st January 1995.
015. Peregrine falcon *Falco peregrinus*, one bird was seen in Sohola on 12th January 1994. The first record for Kaziranga.
016. Laggar falcon *Falco biarmicus*, one was seen flying over Rongamotia camp on 8th April 1994. The first record for Kaziranga.
017. Swamp francolin *Francolinus gularis*, common in the grasslands of Sohola, Turturani and Erakhuti.
018. Elwes's crake *Amaurornis bicolor*, one bird was seen in Turturani kathoni on 15th February 1994. The first record for Kaziranga.
019. Swinhoe's snipe *Gallinago megala*, one bird was seen in Sohola beel on 31st January 1995. Uncommon in Assam.
020. Blackbellied tern *Sterna acuticauda*, seen frequently in Sohola, Rongamotia and Erakhuti beels.
021. Brown hawk-owl *Ninox scutulata*, two birds were seen on a *Zizyphus* tree in the grassland near Balipukuri camp on 8th April 1994. The first record for Kaziranga.
022. Brahminy myna *Sturnus pagodarum*, about 10-12 birds were seen on a flowering *Bombax* tree on 12th January 1994. A straggler to Assam.
023. Lesser whitethroat *Sylvia curruca*, one bird was seen in Rongamotia kathoni on 16th December 1993. An uncommon winter visitor to Assam.

024. Burmese shrike *Lanius colluroides*, a few were seen in the grasslands around Sohola in November 1993. Rare in India.

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Appendix 1

The following list consists of 272 species seen from December '92 to May '95. The list is followed by information on seasonal status, abundance and places of occurrence.

The top-ranking families according to the number of species were Accipitridae (25 species), Anatidae (19 species) and Scolopacidae (10 species).

The scientific names are based on Pittie and Robertson (1993). The common names are those used by Ali and Ripley (1983). The family order also follows Ali and Ripley (1983).

Birds do not recognise boundaries and may be seen anywhere. I have mentioned the places of sightings so that it will help others birdwatching in the area.

The following abbreviations are used:

Un = Unclear	M = Migratory, supplemented with local populations	P = Passage Migrant	U = Uncommon
R = Resident		A = Abundant	O = Occasional
W = Winter		C = Common	S = Stray
		FC = Fairly Common	

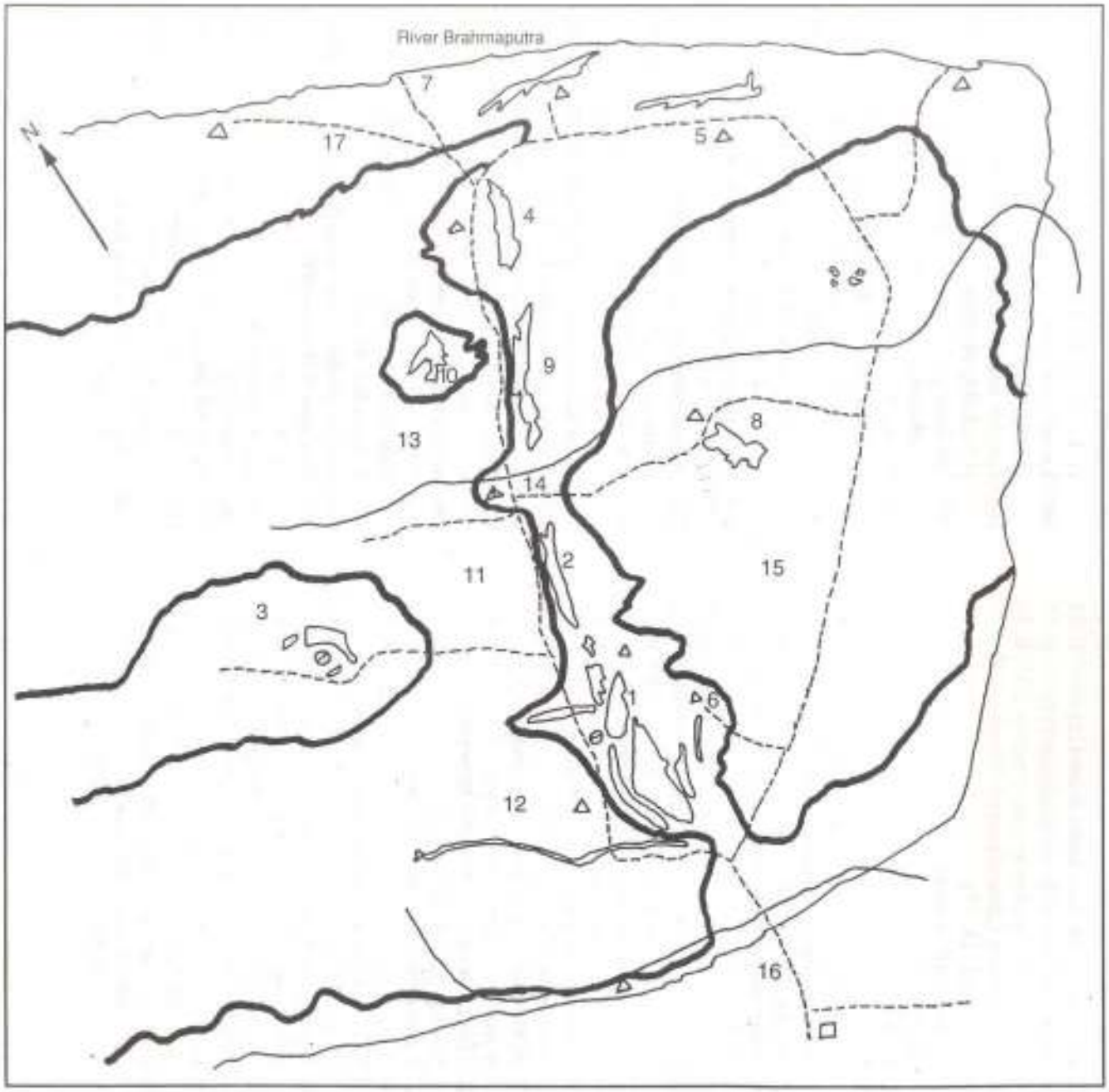
The following abbreviations are used for the places:

1. Sohola beel
2. Rongamotia beel
3. Tini beel
4. Ahotguri
5. Erakhuti
6. Turturani
7. Brahmaputra
8. Belipora
9. Pelican colony
10. Rongamot
11. Kuhimari kathoni
12. Sohola kathoni
13. Rongamotia kathoni
14. Rongamotia camp
15. Turturani kathoni
16. Outside National Park
17. Grassland near Balipukhuri
18. Ubiquitous

001. Little grebe Tachybaptus ruficollis (6) R, FC
002. Great white pelican Pelecanus onocrotalus (1, 2, 8) R, FC
003. Spottedbilled pelican P. phillippensis (1, 2, 3, 4, 5, 6, 8, 9) R, C
004. Dalmatian pelican P. crispus (1, 2) W, U
005. Great cormorant Phalacrocorax carbo (1, 2, 3, 4, 5, 6, 7, 8, 9, 10) R, C
006. Indian cormorant P. fuscicollis (1, 2, 3, 4, 5, 6, 7, 8, 9) R, C
007. Little cormorant P. niger (U) R, A
008. Oriental darter Anhinga melanogaster (1, 2, 3, 4, 5, 6, 8, 9) R, C
009. Grey heron Ardea cinerea (1, 2, 4, 5, 6, 8, 9) R, C
010. Purple heron A. purpurea (1, 2, 3, 4, 5, 6, 8, 9, 10) R, C
011. Indian pond heron Ardeola grayii (U) R, A
012. Chinese pond heron A. bacchus (1) R, U
013. Cattle egret Bubulcus ibis (U) R, A
014. Great egret Casmerodius albus (U) R, C
015. Intermediate egret Mesophoyx intermedia (U) R, A
016. Little egret Egretta garzetta (U) R, C
017. Cinnamon bittern Ixobrychus cinnamomeus (11) R, U
018. Black bittern I. flavicollis (1, 16) R, U
019. Open-billed stork Anastomus oscitans (1, 2, 4, 5, 6, 9) R, C
020. Woolynecked stork Ciconia episcopus (1, 2, 6, 9) R, C
021. Black stork C. nigra (1) W, U
022. Blacknecked stork Ephippiorhynchus asiaticus (1, 2, 4, 5, 6, 8, 9, 10) R, C
023. Greater adjutant stork Leptoptilus dubius (1, 2, 6) R, FC
024. Lesser adjutant stork L. dubius (1, 2, 3, 4, 5, 6, 8, 9, 10) R, C
025. Greylag goose Anser anser (1, 4, 6, 9) W, C
026. Bar-headed goose A. indicus (1, 4, 5, 6, 8, 9) W, C
027. Lesser whistling-duck Dendrocygna javanica (1) R, FC
028. Ruddy shelduck Tadorna ferruginea (1, 2, 4, 5, 6 7, 9) W, C
029. Marbled teal Marmaronetta angustirostris (2) W, S
030. Pintailed duck Anas acuta (1, 2, 4, 5, 6, 8, 9) W, C
031. Common teal Anas crecca (1, 2, 3, 4, 5, 6, 8, 9) W, C
032. Spotbilled duck A. peocilorhyncha (1, 2, 3, 4, 5, 6, 8, 9) M, C
033. Chinese spotbill A. p. zonorhyncha (1, 2, 3, 4, 5, 6, 8, 9) M, C
034. Mallard A. platyrhynchos (1, 2, 3, 4, 5, 6, 8, 9) W, C
035. Gadwall A. strepera (1, 2, 3, 4, 5, 6, 8, 9) W, C
036. Falcated teal A. falcata (2, 8) W, U
037. Wigeon A. penelope (1, 2, 3, 4, 5, 6, 8, 9) W, C
038. Garganey A. querquedula (1) W, U
039. Northern shoveller A. clypeata (1, 2, 3, 4, 5, 6, 8, 9) W, C
040. Common pochard Aythya ferina (1, 2, 4, 5, 6, 9) W, C
041. White-eyed pochard A. nyroca (1, 2, 4, 5, 6, 8, 9) W, C
042. Tufted duck A. fuligula (1, 2, 4, 5, 6, 8, 9) W, C
043. Cotton pigmy goose Nettapus coromandelianus (1) R, FC
044. Black-winged kite Elanus caeruleus (1, 12) R, FC
045. Oriental honey buzzard Pernis ptilorhynchus (12, 13, 14, 15) R, C
046. Black kite Milvus migrans (1) R, U
047. Brahminy kite Haliastur indus (U) R, C
048. Eastern goshawk Accipiter gentilis (12) W, O
049. Shikra A. badius (12, 13, 14, 15) R, C
050. Sparrow-hawk A. nisus (12, 13, 14, 15) R, C
051. Longlegged buzzard Buteo rufinus (16) W, U
052. Japanese buzzard B. buteo japonicus (12, 15) W, U
053. Rufousbellied Hawk-eagle Hieraaetus kienerii (9, 14) R, FC
054. Greater spotted eagle Aquila clanga (1, 2, 4, 5, 6, 9, 10) R, C
055. Pallas's fish-eagle Haliaeetus leucoryphus (1, 2, 4, 5, 6, 8, 9, 10) R, C
056. Greyheaded fish-eagle Ichthyophaga ichthyaetus (1, 2, 4, 5, 6, 8, 9, 10) R, C
057. King vulture Sarcogyps calvus (1, 16) R, U
058. Griffon vulture Gyps fulvus (12, 13, 14, 15) W, U
059. Cinereous vulture Aegipius monachus (15) W, O
060. Longbilled vulture Gyps indicus (U) R, C
061. Whitebacked vulture G. bengalensis (U) R, C
062. Hen harrier Circus cyaneus (1, 16) W, U
063. Pale harrier C. macrourus (1, 2, 4, 5, 6, 9) W, C
064. Pied harrier C. melanoleucos (1, 2, 4, 5, 6, 9) W, C

065. Marsh harrier C. aeruginosus (1, 2, 4, 5, 6, 9) M, C
066. Striped harrier C. spilonotus (9) W, U
067. Crested serpent eagle Spilornis cheela (U) R, C
068. Osprey Pandion haliaeetus (1, 2, 8, 9, 13, 15) R, FC
069. Peregrine falcon Falco peregrinus (1) W, O
070. Laggar falcon F. biarmicus (14) W, U
071. Kestrel Falco tinnunculus (1, 9, 12, 13, 14, 16) W, C
072. Lesser kestrel F. naumanni (1, 16) W, U
073. Swamp francolin Francolinus gularis (1, 5, 6) R, C
074. Red junglefowl Gallus gallus (1, 12, 13, 14, 15) R, C
075. Kaleej pheasant Lophura luecomelana (12, 13, 14, 15) R, C
076. Ruddybreasted crake Porzana fusca (11) R, FC
077. Blacktailed crake Amaurornis bicolor (15) R, U
078. Whitebreasted waterhen A. pheonicurus (1, 2, 3, 6, 11) R, C
079. Watercock Gallicrex cinerea (16) R, U
080. Moorhen Gallinula chloropus (U) R, C
081. Purple swamphen Porphyrio porphyrio (1, 2, 4, 5, 6, 8, 9) R, C
082. Eurasian coot Fulica atra (1, 2, 6) R, FC
083. Pheasant-tailed jacana Hydrophasianus chirurgus (1, 2, 6, 8, 9) R, C
084. Bronzewinged jacana Metopidius indicus (1, 2, 3, 4, 5, 6, 8, 9) R, C
085. Northern lapwing Vanellus vanellus (1) W, U
086. Greyheaded lapwing V. cinereus (1, 6) W, C
087. Redwattled lapwing V. indicus (1, 2, 4, 5, 6, 8, 9) R, C
088. Little ringed plover Charadrius dubius (1, 6) M, C
089. Kentish plover C. alexandrinus (1) W, U
090. Mongolian plover C. mongolus (1) P
091. Blacktailed godwit Limosa limosa (1) W, C
092. Spotted redshank Tringa erythropus (1, 6) W, C
093. Common redshank T. totanus (1, 2, 4, 5, 6, 8, 9) W, C
094. Marsh sandpiper Tringa stagnatilis (1, 2, 4, 5, 6, 8, 9) W, C
095. Greenshank T. nebularia (1, 2, 4, 5, 6, 8, 9) W, C
096. Green sandpiper T. ochropus (1, 2, 6) W, FC
097. Wood sandpiper T. glareola (1, 2, 4, 5, 6, 8, 9) W, C
098. Common sandpiper T. hypoluecos (1, 2, 4, 5, 6, 8, 9) W, C
099. Swinhoe's snipe Gallinago megala (1) W, O
100. Snipe sp. Gallinago sp. (1, 2, 4, 5, 6, 8, 9) W, C
101. Little stint Calidris minuta (1, 6) W, C
102. Temminck's stint C. temmincki (1) W, C
103. Ruff Philomachus pugnax (1) W, U
104. Blackwinged stilt Himantopus himantopus (1, 4) R, C
105. Eurasian avocet Recurvirostra avosetta (1, 4) W, FC
106. Stone curlew Burhinus oedicnemus (1) R, U
107. Great stone plover Esacus magnirostris (7) R, FC
108. Brownheaded gull Larus brunnicephalus (1, 5) W, U
109. Blackheaded gull L. ridibundus (1, 2, 4, 5) W, C
110. River tern Sterna aurantia (1, 2, 3, 4, 5, 6, 7, 8, 9) R, C
111. Blackbellied tern S. acuticauda (1, 2, 4, 5) R, C
112. Common tern S. hirundo (1) W, U
113. Thickbilled green pigeon Treron curvirostra (12, 13, 14, 15) R, C
114. Yellowfooted green pigeon T. pheonicoptera (12, 13, 14, 15) R, C
115. Ashyheaded green pigeon T. pompadora (12, 13, 14, 15) R, C
116. Green imperial pigeon Ducula aenea (12, 13, 14, 15) R, C
117. Mountain imperial pigeon D. badia (13) R, U
118. Blue rock pigeon Columba livia (15) R, C
119. Oriental turtle dove Streptopelia orientalis (12, 13, 14, 15, 16) R, C
120. Eurasian collared dove S. decoacto (1, 3, 8, 10, 12, 13, 14, 16) R, C
121. Spotted dove S. chinensis (U) R, C
122. Red collared dove S. tranquebarica (1, 3, 8, 10, 12, 13, 14, 16) R, FC
123. Emerald dove Chalcophaps indica (12, 13, 14, 15) R, C
124. Alexandrine parakeet Psittacula eupatrica (U) R, C
125. Roseringed parakeet P. krameri (U) R, A
126. Redbreasted parakeet P. alexandri (U) R, C
127. Blossomheaded parakeet P. roseata (1, 2, 3, 6, 8, 11, 12, 13, 14, 15, 16) R, FC

128. Greyheaded parakeet P. finschii (11, 12, 15) R, U
129. Pied cuckoo Oxylophus jacobinus (16) Sm, ?
130. Indian cuckoo Cuculus micropterus (12, 13, 14, 15, 16) Sm, C
131. Drongo-cuckoo Surniculus lugubris (11) Un, U
132. Asian koel Eudynamys scolopacea (11, 12, 13, 14, 15, 16) R, C
133. Greenbilled malkoha Rhopodytes tristis (8, 14) R, U
134. Greater coucal Centropus sinensis (U) R, C
135. Lesser coucal C. bengalensis (1, 2, 3, 6) R, FC
136. Mountain scops owl Otus spilocephalus (15) R, U
137. Eurasian eagle-owl Bubo bubo (12) R, FC
138. Dusky eagle-owl B. coromandus (14) R, U
139. Brown fish owl Ketupa zeylonensis (1) R, FC
140. Jungle owlet Glaucidium radiatum (11, 12, 13, 14, 15) R, FC
141. Barred owlet Glaucidium cuculoides (11, 12, 13, 14, 15) R, C
142. Brown hawk-owl Ninox scutulata (17) R, U
143. Great eared nightjar Eurostopodus macrotis (14) R, U
144. Grey nightjar Caprimulgus indicus (11, 12, 13, 14, 15) R, C
145. Asian palm swift Cypsiurus balasiensis (1, 3, 6, 11, 13, 14, 15, 16) R, C
146. Swift sp. Apus sp. (1, 3, 6, 13, 14, 15) R, C
147. Pied kingfisher Ceryle rudis (1, 2, 3, 4, 5, 6, 8, 9) R, C
148. Common kingfisher Alcedo atthis (1, 2, 3, 4, 5, 6, 8, 9, 11) R, C
149. Whitethroated kingfisher Halcyon smyrensis (U) R, A
150. Storkbilled kingfisher Pelargopsis capensis (1, 2, 4, 5, 6, 9, 11) R, C
151. Chestnutheaded bee-eater Merops leschenaulti (1, 2, 3, 11, 12, 13, 17) R, C
152. Little green bee-eater M. orientalis (1, 2, 3, 11, 12, 13, 17) R, C
153. Blue-tailed bee-eater M. philippinus (1, 12, 17) R, C
154. Bluebearded bee-eater Nyctyornis arthertoni (13, 14) R, FC
155. Indian roller Coracias benghalensis (U) R, C
156. Dollarbird Eurystomus orientalis (12) R, U
157. Eurasian hoope Upupa epops (1, 6, 12, 16) M, C
158. Oriental pied hornbill Anthracoceros albirostris (11, 12, 13, 14, 15) R, C
159. Great hornbill Buceros bicornis (12, 13, 14, 15) R, C
160. Lineated barbet Megalaima lineata (11, 12, 13, 14, 15, 16) R, C
161. Bluethroated barbet M. asiatica (U) R, C
162. Coppersmith barbet M. haemacephala (11, 12, 13, 14, 15, 16) R, C
163. Speckled piculet Picumnus innominatus (12) R, U
164. Rufous woodpecker Celeus brachyurus (12, 13, 14, 15) R, C
165. Streakthroated woodpecker Picus xanthopygaeus (13, 14) R, FC
166. Greyfaced woodpecker P. canus (1, 6, 11, 12, 13, 14, 15) R, C
167. Lesser yellownape P. chloropus (12, 13, 14) R, FC
168. Greater yellownape P. flavinucha (11, 12, 13, 14, 15) R, C
169. Blackrumped flameback Dinopium benghalense (U) R, C
170. Fulvousbreasted woodpecker Dendrocopos macei (11, 12, 13, 14, 15) R, C
171. Greycapped woodpecker D. canicapillus (12, 13, 14, 15, 17) R, C
172. Great flameback Chrysocolaptes lucidus (12, 13, 14, 15, 17) R, C
173. Rufouswinged lark Mirafra assamica (1, 5, 6) R, C
174. Ashycrowned sparrow-lark Eremopterix grisea (1) R, U
175. Oriental skylark Alauda gulgula (1, 3, 5, 6, 16) M, C
176. Plain martin Riparia paludicola (1, 7) R, C
177. Barn swallow Hirundo rustica (U) M, C
178. Redrumped swallow H. daurica (1, 16) M, C
179. Nepal house martin Delichon nipalensis (1, 6, 16) M, C
180. Asian house martin D. urbica (1, 6) W, U
181. Burmese shrike Lanius colluroides (1) P
182. Greybacked shrike L. tephronotus (U) W, C
183. Longtailed shrike L. schach (1, 3, 5, 6) W, FC
184. Brown shrike L. cristatus (U) W, C
188. Blackhooded oriole Oriolus xanthornus (U) R, C
189. Black drongo Dicrurus macrocercus (U) R, C
190. Crowbilled drongo D. annectans (11) R, U
191. Bronzed drongo D. Aeneus (13, 14) R, FC
192. Lesser racket-tailed drongo D. remifer (12, 13, 14, 15) R, C
193. Ashy drongo D. leucophaeus (12, 13, 14) R, C



Reference

= Wetland
= Motorable Road
= Woodland
= Forest Camp
= River
= Beat Office
= Park Boundary
= Range Office

1. Sohola (kathoni) Beel
2. Rongamota Beel
3. Tini Beel
4. Ahotguri
5. Erakhuti
6. Turturani
7. Brahmaputra river
8. Belipora
9. Pelican colony
10. Rongamotia jaan
11. Kuhimari kathoni
12. Sohola kathoni
13. Rongamotia kathoni
14. Rongamotia camp
15. Turturani kathoni
16. Outside National Park
17. Grassland near Balipukhuri camp

Fig. 1 : Sketch Map of Agaratoli Range (not to scale)

194. Haircrested drongo D. hottentottus (12, 13, 14, 15) R, C
195. Greater racket-tailed drongo D. paradiseus (12, 13, 14, 15) R, C
196. Ashy wood swallow Artamus fuscus (1, 2, 8, 11, 12, 13, 14, 16) R, C
197. Spotwinged stare Saroglossa spiloptera (1, 2, 8, 11, 12, 13, 14, 15) W, A
198. Chestnut-tailed starling Sturnus malabaricus (11, 12, 13, 14, 16) R, C
199. Brahminy starling S. pagodarum (14) W, S
200. Asian pied starling S. contra (1, 2, 3, 5, 6, 8, 9, 16) R, C
201. Bank myna Acridotheres ginginianus (1, 6) R, FC
202. Jungle myna A. fuscus (U) R, C
203. Common myna A. tristis (1, 2, 3, 4, 5, 6, 8, 16) R, C
204. Hill myna Gracula religiosa (13, 14) R, U
205. Large wood shrike Tephrodornis gularis (13, 14) R, U
206. Large cuckoo-shrike Coracina macei (11, 12, 13, 14, 16) R, C
207. Scarlet minivet Pericrocotus flammeus (11, 12, 13, 14, 15) R, C
208. Longtailed minivet P. ethologus (12, 13, 14, 15) R, FC
209. Shortbilled minivet P. brevirostris (13, 14) R, FC
210. Small minivet P. cinnamomeus (13) R, U
211. Common iora Aegithina tiphia (13, 14) R, C
212. Goldfronted chloropsis Chloropsis aurifrons (13, 14) R, U
213. Blackcrested bulbul Pycnonotus melanicterus (13, 14) R, FC
214. Redwhiskered bulbul P. jocosus (13, 14, 15) R, C
215. Redvented bulbul P. cafer benghalense (U) R, A
216. Black bulbul Hypsipetes luecocephalus (11, 12, 13, 14) R, U
217. Puff-throated babbler Pellorneum ruficeps (13, 14) R, FC
218. Longtailed sibia Heterophasia picaoides (11, 12, 15) R, FC
219. Ferruginous flycatcher Muscicapa ferruginea (12, 13) R, U
220. Redbreasted flycatcher Ficedula parva parva (11, 12, 13, 14, 15) R, C
221. Little pied flycatcher F. westermanni (11, 12, 13, 14) R, C
222. Small niltava Niltava macgrigoriae (8, 11, 13) R, FC
223. Verditer flycatcher Eumyias albicaudata (11, 13) W, C
224. Greyheaded flycatcher Culicapa ceylonensis (11, 12, 13, 14, 15) M, C
226. Zitting cisticola Cisticola juncidis (1) R, FC
227. Ashy prinia Prinia socialis (1) R, FC
228. Plain prinia P. inornatus (1, 2, 6) R, C
229. Common tailorbird Orthotomus sutorius (1, 2, 11, 12, 13, 14, 15, 16) R, C
230. Mountain tailorbird O. cuculatus (13) R, U
231. Striated marsh warbler Megalurus palustris (1, 2, 16) R, C
232. Paddyfield warbler Acrocephalus concinens (11) W, C
233. Dusky warbler Phylloscopus fuscatus (1, 2) W, C
234. Blyth's leaf warbler P. reguloides (1, 11, 13) W, C
235. Greyhooded warbler Seicercus x anthoschistus (13) R, C
236. Magpie-robin Copsychus saularis (U) R, C
237. Shama C. malabaricus (11, 12, 13, 14, 15) R, C
238. Black redstart Pheonicurus ochrurus (1, 11, 12, 13, 14) W, C
239. Daurian redstart P. auroreus (1, 11) W, C
240. Lesser whitethroat Sylvia curruca (13) W, U
241. Tibetan collared Bush chat Saxicola torquata prezwalskii (U) W, C
242. Indian collared bush chat S. t. indica (U) M, C
243. Himalayan whistling thrush Myiophonus caeruleus (11, 12, 13) M, C
244. Orangeheaded ground thrush Zoothera citrina (12, 13, 14, 15) M, C
245. Golden mountain thrush Z. dauma (8, 13) W, C
246. Grey tit Parus major (8, 11, 12, 13, 14, 15) R, C
247. Velvetfronted nuthatch Sitta frontalis (11, 12, 13) R, FC
248. Indian tree pipit Anthus hodgsoni (11, 12, 13, 14) W, C
249. Paddyfield pipit A. rufulus (1, 6, 16) W, C
250. Tawny pipit A. campestris (1, 6) W, C
251. Vinaceousbreasted pipit A. roseatus (1, 6) W, C
252. Forest wagtail Anthus indica (13, 14) R, FC
253. Greyheaded yellow wagtail M. flava thunbergi (1, 6, 16) W, C
254. Blueheaded yellow wagtail M. f. beema (1, 16) W, FC

255.	Northern yellowheaded wagtail M. citreola citreola (U)	W, C
256.	Grey wagtail M. caspica (1, 2, 4, 5, 6, 8, 9, 16)	W, C
257.	Indian pied wagtail M. alba dukhunensis (U)	W, C
258.	Masked wagtail M. a. personata (U)	W, C
259.	Hodgson's pied wagtail M. a. alboides (U)	W, C
260.	Whitefaced pied wagtail M. a. leucoscopis (1, 16)	W, FC
261.	Swinhoe's pied wagtail M. a. baicalensis (16)	W, U
262.	Tickell's flowerpecker Dicaeum ignipectus (13, 14, 16)	R, C
263.	Scarletbacked flowerpecker D. cruentatum (13, 14)	R, FC
264.	Yellowbacked sunbird Aethopyga siparaja (8, 11, 12, 13, 14, 15, 16)	R, C
265.	Mrs. Gould's sunbird A. gouldiae (16)	W, U
266.	Tree sparrow Passer montanus (16)	R, C
267.	Cinnamon tree sparrow P. rutilans (16)	R, FC
268.	Indian white-eye Zosterops palpebrosa (13, 14)	R, C
269.	Blackthroated weaverbird Ploceus benghalensis (16)	R, C
270.	Red munia Estrilda amandava (1)	R, U
271.	Spotted munia Lonchura punctulata (1, 16)	R, C
272.	Blackheaded munia L. mallacca (1, 2)	R, C

Appendix 2

The following birds have been seen in Agaratoli by reliable observers but not seen by me.

1. Great Whitebellied Heron Ardea insignis
2. Yellow Bittern Ixobrychus sinensis
3. Bonelli's Hawk-eagle Hieraaetus fasciatus
4. Changeable Hawk-eagle Hieraaetus cirrhatus
5. Bengal Florican Houbaropsis bengalensis
6. Lesser Spotted Eagle Aquila pomarina
7. Orangebilled Jungle Myna Acridotheres grandis
8. Indian Lorikeet Loriculus vernalis
9. Large Niltava Niltava grandis