PROCEEDINGS OF THE NATIONAL SYMPOSIUM ON GALLIFORMES

February 20-22, 2002

Organized by

DIVISION OF WILDLIFE BIOLOGY

A.V.C. COLLEGE [AUTONOMOUS]

Mannampandal, Mayiladuthurai - 609 305

Tamil Nadu

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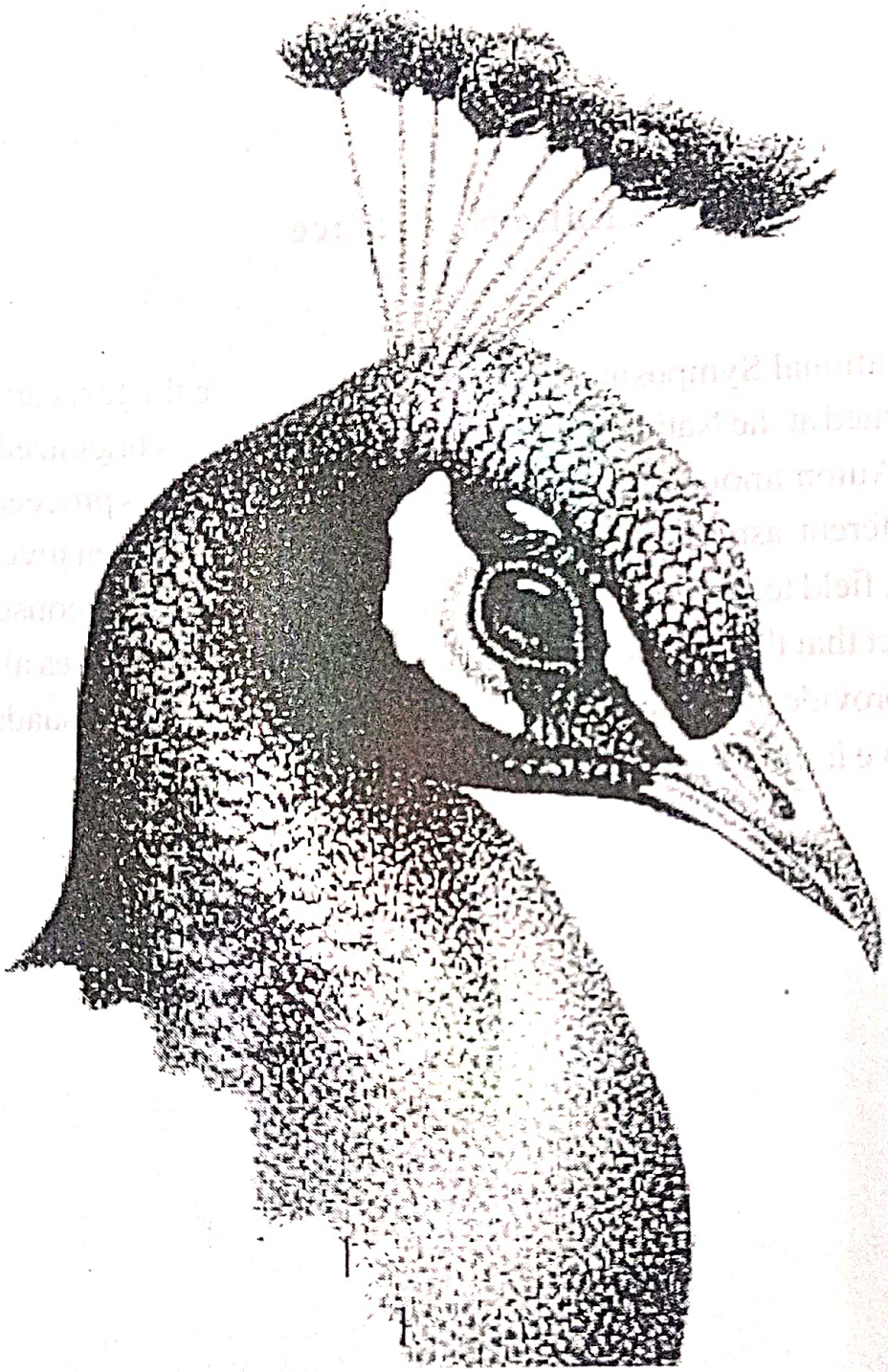
Chief Editor : M.C. Sathyanarayana
Editors : S.Sathyakumar, Rahul Kaul and Rajiv S. Kalsi

Editors' Preface

The Proceedings of the National Symposium on Galliformes include the texts and abstracts of papers on Galliformes in India presented at the National Symposium on Galliformes organized by Division of Wildlife Biology, A.V.C.College[Autonomous], Mayiladuthurai, Tamilnadu. This proceedings help us to update existing knowledge on different aspects of Galliformes. Importance has been given for status, distribution, ecology, habitat utilization, field techniques, behaviour, genetics, diseases and conservation of galliformes in India. It is a well known fact that the conservation and management programmes always depends on the out come of the surveys which provide the basic data so as enable the Biologists to persuade governments of the vital need to preserve and conserve important galliformes habitats.



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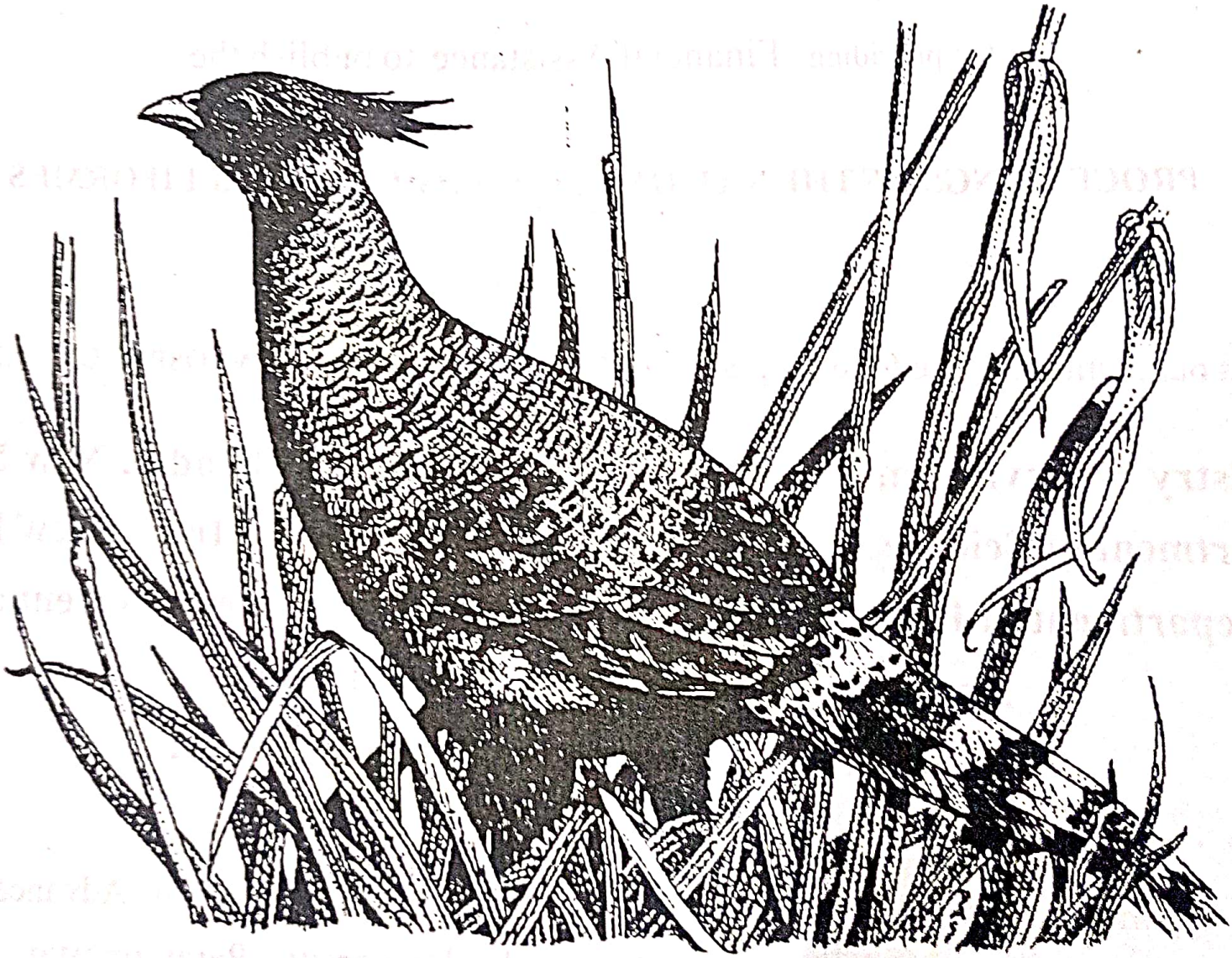
A.V.C. Education Committee, Mannampandal

We take this opportunity to thank **Prof. R. Natarajan**, Director(Rtd), Centre for Advance Studies in Marine Biology, Marine Biological Station, Annamalai University, Parangipettai, Tamilnadu and the Editors for critically going through the manuscripts.



CONTENTS

Population & Behaviour

Conservation & Management

ABSTRACTS

Conservation Status of Galliformes

Conservation and Management

Welcome Address

V. Radhakrishnan

Principal, A.V.C.College[Autonomous],Mannampandal, Mayiladuthurai 609 305,Tamilnadu

It gives me a great pleasure to welcome Dr.Balaji, I.F.S. Director, Department of Environment, Govt.of Tamilnadu who has readily accepted to be with us and deliver the Key Note address during the Inaugural session. I take this opportunity to welcome Mr.C.Senthilvel, Secretary , A.V.C. Education Committee. I am very glad to welcome Dr.Sathyakumar, Scientist, Wildlife Institute of India, Dehradun and delegates from Himachal Pradesh, Dehradun, Haryana, Aligarh, Mumbai and Tamilnadu. I extend a warm welcome to our guests, invitees, staff and students.

Mayiladuturai, popularly known as "Mayavaram" a city of temples and a seat of learning is situated on the banks of River Cauvery in Nagai (Nagapattinam) district, Tamil nadu. The Anbanathapuram Vahaira Charities [A.V.C] was established in 1806 AD by the philanthropic members of the five families of Anbanathapuram, Enathimangalam, Pallavaraypet, Kargudi and Kanganamputhur. Thiru S.Ramalingam Pillai set apart a sixth share of his property of his deceased son Thiru Velayudham Pillai for Charitable purposes. His descendants settled down at Anbanathpuram, Enathimangalam, Pallavaraypet, Kargudi and Kanganamputhur villages. The property which was endowed for public charitable causes was managed by the eldest male members of the five families. Right from its inception , the A.V.C. Charities is serving the humanity in the field of religion and Charitable activities, by contributing to the performance of daily pujas in almost all temples in and around Mayiladuturai of Tajnore district and Chidambaram of South Arcot district in Tamilnadu .In 1955 the A.V.Charities established the A.V.C. College to serve the cause of higher education. It was in 1955 the A.V. Charities founded the A.V.C. College to serve cause of higher education and the reputed service of the college is well recognized throughout Tamilnadu.

India is gifted with most beautiful and magnificent galliformes. These birds are good Indicator species because their abundance can be used to judge the general health of a habitat. The decline in their status can be taken as an early sign that a piece of habitat is being degraded. We have peafowl, Grey junglefowl, grey partridges, quails and red spur fowl in Tamilnadu I am very much shocked to know that the Pheasant Specialist Group has concluded that of the 69 taxa considered, four (6%) are critically threatened with extinction, 16 (23%) are endangered and 24(35%) are vulnerable. Western tragopan in the western Himalayas of India is threatened specially by habitat degradation. Hence Galliformes scientists have crucial role to play in the perpetuation of this group of birds. We also join with you not only in safeguarding these birds but also to improve the existing population.

I wish the Symposium all success.

Introduction to the Symposium

M.C. Sathyanarayana
Organizing Secretary, National Symposium on Galliformes
Division of Wildlife Biology, A.V.C.College[Autonomous], Mannampandal 609 305, Tamilnadu.
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Galliformes include a group of birds like peafowls, junglefowls, Western tragopan, Cheer pheasant, monals etc., Many galliformes are rather well known to Indians from all walks of life, and serves as an ideal 'flagship' group for tackling conservation problems. The major theme of this symposium is on conservation and management of galliformes in India.

This Three-day National Symposium on Galliformes consists of a series of invited and contributed oral presentations, followed by discussions.

Topics for this symposium are :

Survey and distribution of galliformes in India.
Status of galliformes
Habitat ecology and Habitat utilization
Habitat degradation
Conservation problems
Conservation of galliformes
Conservation Genetics of the wild ancestor-Red junglefowl
Management of endangered and vulnerable species
Diseases and Health care
Captive Breeding
Trade in galliformes
Participation of stakeholders in the conservation
Environmental education and Awareness
Role of Eco-clubs in conservation

This national symposium is aimed at bringing together scientists from different parts of India, who can freely share and exchange scientific knowledge and ideas. The emphasis throughout will be on open and free discussion through active participation of all delegates.

The presentations on different aspects of galliformes will form the base for planning a sound wildlife management, and also can help to fill the gaps in ecological research. The recommendations to be made at the end will help to revise and undertake appropriate action plans for effective and efficient conservation programmes. The outcome of deliberations will also add to our knowledge and can contribute to improve the quality of teaching, research and outreach strategies.

Inaugural Address

C. Senthilvel
Secretary, A.V.C. Education Committee, Mayiladuthurai 609 305, Tamilnadu

I am very happy to know that all those working and interested in Galliformes birds have come all the way from Dehradun, Aligarh, Haryana, Mumbai, Tamilnadu and other parts of our country. It is a privilege to inform you that A.V.C. College is the only Institution offering a two year post graduate course in M.Sc Wildlife Biology in south India. The faculty members have undertaken a number of Research Programmes sponsored by Ministry of Environment & Forest, University Grants Commission, Department of Science & Technology, Indian Council of Agricultural Research, Tamilnadu Forest Department and U.S. Fish & Wildlife Services.

I am very glad to place before you on this occasion that Dr.Philip Mc Gowman, Conservation Director, World Pheasant Association, UK says that A.V.C .college has provided some outstanding biologists with whom we are delighted to have the chance to work. The World Pheasant Association Council appreciated Dr.M.C.Sathyanarayana and his Research scholars for their keen interest in Galliformes.

The birds belonging to Galliformes are most beautiful, majestic and magnificent and possibly because of the same, these birds are facing many threats due to illegal human activities . It is the duty of the Scientists and Conservationists to safeguard not only the galliformes but Biodiversity in total.

I wish the symposium every success.

Thank you one and all

Key Note Address

S. Balaji,
Director,
Department of Environment, Government of Tamil Nadu, Panagal Building, Saidapet, Chennai - 600 015

I am happy to participate in this National Symposium on Galliformes between February 20-22, 2002, organized by Wildlife Biology Division of A.V.C.College, Mayiladuthurai. I am happy to note that the symposium will deliberate on status, habitat conservation, and problems in management, captive breeding, trade, environmental education and role of eco-clubs in protection of Galliformes.

Birds are good indicators of biodiversity status of forests. A study conducted at Salem and Dindigul districts revealed that birds are good indicators of the biodiversity enhancement in general and species abundance in particular. The group of birds known as the Galliformes has the closest association with man than any other bird groups. This group includes such familiar species as Indian peafowl and the Red junglefowl, which are the ancestors of all the world's domesticated chickens.

In total, this group contains over 280 species from allover the world. India is home to 42 species of galliformes, which includes 16 species of pheasants, 25 species of partridges, quail and francolin and one megapode.

Most of the Galliformes species are often referred to as 'game birds'. Threat to the continued existence of a number of these birds must be regarded as severe. In some cases, the risk of extinction arises from an expanding human population, over-exploitation of them for food and loss of habitat due to fragmentation of natural forests, scrub and grass land habitat. According to ICBP's Red Data Book, among endangered bird species, 12 (29%) are currently threatened with extinction.

Because of their fondness for vegetal cover, largely vegetarian diet, and ground-nesting habitat, the pheasants and their allies are good bio indicators of the general health of habitat. The value of indicator species lies in the fact that they can be detected and counted easily, so that a decline in their status can be taken as an early warning sign of habitat degradation. Some of the birds are large and beautiful in shape and colour, and have great ornamental value. Environment concerns every one as it deteriorates, particularly in urban areas, and it is our duty to strive for the betterment of environment to help our next generation.

Department of Environment, Government of Tamil Nadu has expanded school eco-clubs in all the 30 districts this year. There are about 50000 eco-club members in 1200 eco-clubs across the state. These eco-clubs are undertaking environmental awareness, campus cleaning, tree planting, vermi composting, etc. Creating awareness about conservation of forests and Wildlife is integral for the functioning of these

eco-clubs. Besides eco-clubs, National green crop (NGC) units would be started during the course of next month in all the 30 districts. These units would preferably be started in middle schools. In total, 3000 such units with a strength of 1.20 lakh members, would start functioning and the Ministry of Environment and Forests would provide assistance to the tune of Rs. One lakh per district for this scheme. I am sure a Symposium of this sort will address specific conservation requirement of this birds group, which is dear to all of us. I am sure the recommendation of this Symposium will be useful towards better conservation of these birds.

I wish the Symposium all success.

Proceedings of the National Symposium on Galliformes
Division of Wildlife Biology, A.V.C. College [Autonomous], Mayiladuturai 609 305.

Status and distribution of Cheer Pheasant, *Catreus wallichii* in Garhwal Himalaya, Uttaranchal

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ABSTRACT

Pilot surveys were conducted to know the status and distribution of threatened Cheer pheasant in Garhwal Himalaya, Uttaranchal. More than 13 areas holding Cheer populations were identified, all outside the protected habitats in the districts Pauri and Chamoli. Populations having large groups (>6 individuals) were sighted in few areas only viz. Adwani, Agrora (in district Pauri), and Nandprayag (in district Chamoli). Hunting and habitat destruction due to the forest fire were observed to be the main reasons for population decline of Cheer pheasant.

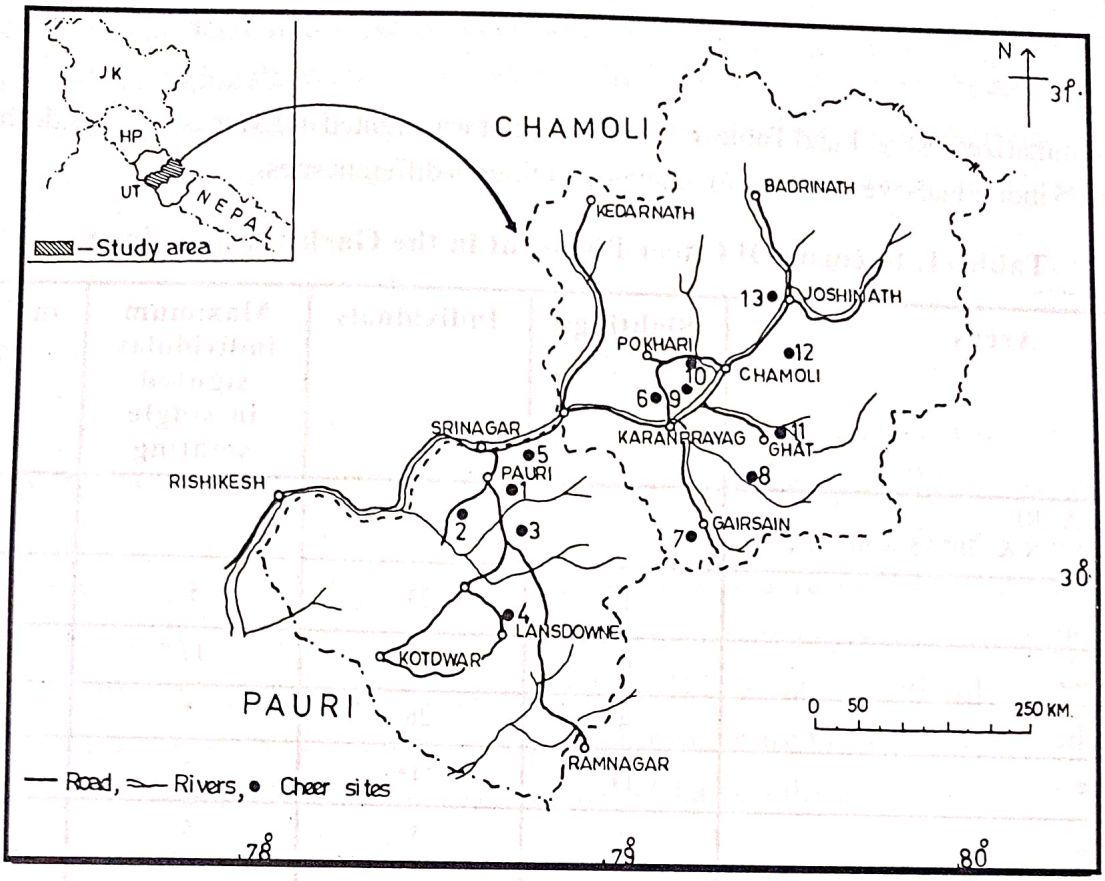
INTRODUCTION

Cheer pheasant, *Catreus wallichii* (Hardwickie) is a game bird of the Himalaya. Its historical distribution was range from north-west Pakistan to west central Nepal between the rivers Indus and Kali-Gandaki (Delacour, 1977, Ali and Ripley, 1983). In the past, especially after the independence, illegal hunting and wide scale habitat destruction have caused declines in the populations of Cheer pheasant. Until few years ago only a few selected sites were known to hold Cheer populations along the entire distributional limit (Roberts, 1970; Lelloitt ,1981, 1987; Rasool, 1994; Young *et al.* 1987; Garson *et al.* 1992).

In Garhwal Himalaya no scientific study has been conducted on status and distribution of the Cheer pheasant. All available information is based on accounts of the British naturalists living in India before independence (Gould, 1832; Jerdon, 1864; Hume and Marshall, 1879). The present communication describes the finding of surveys conducted from October 2000 to December 2001 on distribution of Cheer pheasant in the Pauri and Chamoli districts of Uttaranchal.

STUDY AREA

Garhwal Himalaya is located in the Central Himalaya and extends from 29^0 26' N to 32^0 28'N and 77^0 49' E to 80^0 06' E Fig. 1.



The Pauri and Chamoli districts of Garhwal which were collectively known as "British Garhwal" before independence were selected for present study. Due to great altitudinal variations from 400m to 7,817m (Nanda Devi peak), a variety of habitats are found in three ecological zones viz. subtropical, temperate and alpine zone. In the middle range of the study area, the Chir-pine and pine mixed forests are characteristically inhabited by Cheer pheasant. In local dialect this pheasant is known as "Chair" or "Phaklas".

METHODS

Based on secondary information from local people (e.g. ladies who routinely visit to the forests for fuel and fodder collection, hunters, forest personnel etc) visits were made in potential areas excluding the protected habitats. A team consisting 2-3 members made frequent visits in early morning (5 am to 10 am) and evening (2 pm to sunset) at each site.

More than 25 areas in different parts of Pauri and Chamoli districts were surveyed. Trail walks method (Gaston, 1980) was used. We walked on ridges, slopes and valleys during the trail monitoring method. At each site visits were made for 4 to 7 days and data were collected on number of Cheer sighted, group size, location of site, altitude, aspect and habitat type.

RESULTS

Findings are summarized in Fig-1 and Table-1. Cheer pheasant was sighted in 13 areas, all out side the protected habitats. Total 75 individuals were sighted in separate sightings at different sites.

Table -1. Records Of Cheer Pheasant in the Garhwal Himalaya

Areas	Sightings	Individuals	Maximum individulas sighted in single sighting	individulas/ sighting
DISTRICT - PAURI (29° 22'N 30° 17' N & 70° 15'N to 79, 17°E)				
1. Pauri	7	29	5	4.14
2. Adwani	4	38	12	9.5
3. Agrora	4	26	9	6.50
4. Landsdowne	14	74*	7	5.28*
5. Kherakhal	1	5	5	5.00
DISTRICT - CHAMOLI (29° 52'N 31° 7' N 78° 7'E to 80, 10°E)				
6. Karanprayag	13	77*	5	5.91
7. Gairsain	4	10	2	2.50
8. Narayanbagar	5	16	4	3.20
9. Nandprayag	13	81*	6	6.23
10. Trisula	10	45	6	4.50
11. Ghat area	2	7	4	3.50
12. Peepalkoti	4	17	5	4.25
13. Joshimath	5	23	5	4.60

* Including chicks and sub adults

In the district Pauri, Cheer was sighted in Pauri, Adwani, Agrora, Kherakhal and Lansdowne areas and mean number of individuals per sighting were 4.14 ± 0.53, 9.50 ± 0.64, 6.50 ± 1.44, 5.00 and 3.35 ± 0.42 respectively. In Kherakhal area, 5 Cheer were sighted in single sighting. In the Chamoli district, Cheer pheasant was recorded in 8 areas viz. Karanprayag, Gairsain, Narayanbagar, Nandprayag, Trishula, Ghat, Peepal koti and Joshimath with 3.15 ± 0.31, 2.50 ± 0.17, 3.20 ± 0.53, 4.46 ± 1.12, 4.40 ± 0.65, 3.50 ± 0.49, 4.25 ± 0.75 and 4.60 ± 1.28 individuals/sighting respectively. The group size in most of the areas was found to be small, consisting 2 to 6 birds.

Altitudinally, Cheer was found from 950m to 2100m altitude on all North, South, East and West aspects but it preferred north and east facing slopes. In our study areas, Cheer was observed inhabiting pure Chir-pine forest (*Pinus roxburghii)* and Pine-mixed forest (*P.roxburghii, Quercus, Rhododendron* and *Myrica)* only. At some sites it was found sympatric with White-crested kalij, *Lophura leucomelana hamiltoni* and Koklass, *Pucrasia macrolopha.*

DISCUSSION

From results of our surveys it appears that Cheer pheasant is still well distributed in Garhwal Himalaya, even out side the protected habitats (national parks, sanctuaries and biosphere reserve). The pheasant can be sighted any where in habitats having rocky cliffs, long grasses, and the Chir pine with other trees (like *Phyllanthus emblica, Quercus, Rhododendron* and *Myrica).* But records of small numbers of birds at most of the sites indicate that the population of this threatened species is under pressure in this region too. Only few populations (having good number of birds viz., >6 individuals per group) seem safe because access to these site is not easy or the motor roads are far from habitats like in Adwani, Agrora (in the districts Pauri) and Nandprayag area (in Chamoli district).

Illegal hunting and habitat destruction seem to be the main threats to Cheer pheasant in Garhwal Himalaya. In spite of complete ban on hunting under the Wildlife Protection Act (1972) killing of wild animals especially pheasants in winter months (November to February) is common practice throughout the region. Our survey team noticed plucked feathers of dead Cheer at many sites. In the Pauri district at one site, seven Cheer were shot dead from a small locality in two consecutive days as reported by a local hunter. Forest fire is another critical factor in whole Uttaranchal State. Especially during summer months (May-June), when forests become prone to fire due to the resin secretion and dry litter accumulation, the local people light fires to encourage healthy growth of grass. As a result, fire not only damages the habitats of pheasant viz. Chir-pine and Pine-mixed forest but also destroys the brooding birds. To save Cheer pheasant in the Uttaranchal, which is known for its rich biodiversity, there is a need of regular monitoring of populations, protection of habitats, complete restriction on hunting and fire and creation of ecological awareness for benefit of new state and its people.

ACKNOWLEDGEMENT

Senior author is thankful to the Ministry of Environment and Forests. Govt. of India and UGC- New Delhi for providing the financial assistance. Thanks are also due to the Chief Wildlife Warden of the Uttaranchal state for granting permission to carry out survey in the study area.

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Distribution, Status and Relative abundance of Grey Junglefowl in Theni Forest Division, Tamilnadu

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ABSTRACT

A rapid survey was carried out to understand the distribution and status of Grey junglefowl (*Gallus sonneratii*) in Theni Forest Division (9°31'-10°10'N, 77°20'-77°40'E) Meghamalai, Tamilnadu. Other objective of the survey was to identify areas for intensive field investigation. Parts of Gudalur and Meghamali Ranges chosen as intensive study sites on the basis of relatively high abundance of Grey junglefowl and adequate representation of various habitat types found in these ranges. Line transects were laid in five different habitat types: (1) Southern Deciduous Scrub Forest (SDSF), (2) Southern Dry Mixed Deciduous Forest (SDMDF), (3) Southern Moist Mixed Deciduous Forest (SMMDF), (4) Miscellaneous + Plantation Forest (MISC+PL) and (5) Southern Sub-Tropical Hill Forest (SSTHF). Density estimates were obtained from counts made during morning and evening transect walks. Of these habitat types sampled, SDSF had the highest density (18.2 birds/ km²) followed by MISC+PL (17.59 birds/ km²). There was no sighting of Grey junglefowl in SSTHF, which represent the hill forests. This paper reports the possible reasons for variations in the density estimates of Grey junglefowl.

INTRODUCTION

The grey or Sonnerat's junglefowl is one of the four species in the genus *Gallus*, species *sonneratii* which is truly endemic to southern India. Its distribution is confined to peninsular India which extends up to Mount Abu in Rajasthan in the North. Occurring from sea level to 5000 feet, it inhabits evergreen as well as shrub, bamboo, teak and mixed forests (Johnsgard, 1986). The Grey junglefowl has received little attention and although its numbers may be high in certain areas, it has been reported that there is an overall decline in its numbers (Coote, 1992). The Grey Junglefowl is considered as one of the near-threatened species, with a fragmented range (Fuller and Garson, 2000). The World Pheasant Association-India has also formulated a conservation strategy for Grey junglefowl. In it they suggested undertaking an intensive study of their status, distribution, ecology and behaviour so as to prepare an effective management plan. The Grey Junglefowl acts as a good indicator species. The World Pheasant Association regards Grey junglefowl as an important species for study because it has shown decreasing trends over the last few decades. During the Wynad bird survey, Zacharias (1993) found only few numbers of Grey junglefowl, than expected. He informed that, for conserving this species, efficient management is essential which has to be supported by an in-depth research. Kaul and Garson (1992)

reported that there is very little survey information to help in the conservation of Grey junglefowl. Habitat utilization by Grey junglefowl in the north western parts of Bori Wildlife Sanctuary; Madya Pradesh was studied by Tata and Gautam (1992). Zacharias (1997) has presented a brief account on the status of Grey juglefowl in Periyar Tiger Reserve (PTR), Kerala. Singh (1995) proposed that a thorough investigation is required in order to determine the current status of Grey junglefowl. In view of the aforesaid facts a study has been taken up to find out the habitat utilization of Grey junglefowl. This paper describes habitat utilization by Grey junglefowl based on sightings from transect surveys in five different habitats in Theni Forest Division.

STUDY AREA

The Theni Forest Division (9°31'-10°10'N, 77°20'-77°40'E) is located in Theni district, Tamilnadu. This area forms part of the Western Ghats and it is located on the boundary of Tamilnadu and Kerala State (Fig:1).

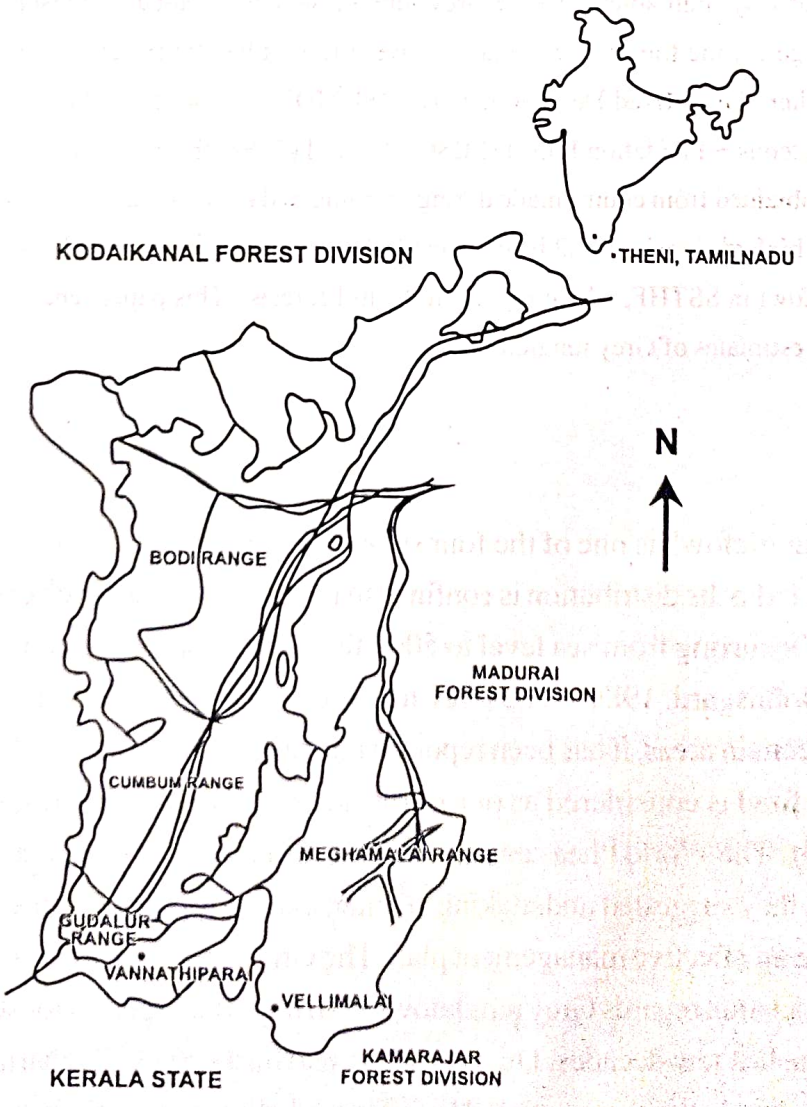


Fig. 1 Map showing study area in the Theni Forest Division

This forest covers an area of 723 sq.km. It comprises of Bodi range, Cumbum range, Gudalur range and Meghamalai range (Fig.1). The elevation ranges from 300 m to 1550m. The rainfall varies between 700mm and 2000mm. The important rivers are Periyar, Suruliyar, and Vaigai. The vegetation types (habitats) include Southern Deciduous Scrub Forest, Southern Dry Mixed Deciduous Forest, Southern Moist Mixed Deciduous Forest, Miscellaneous+plantation Forest and Southern Sub-Tropical Hill Forest.

Southern Deciduous Scrub Forest (SDSF):

The habitat with 50% of canopy cover is characterized by the presence of the dominant tree species such as *Schleichera oleosa, Albizzia amara, Ailanthus excelsa* and *Aacia chundra*. The shrub cover is dominated by *Lantana camera* and *Acacia torta* interspersed with numerous small clearings with lot of litter availability. The altitude ranges from 325 to 350 mts.

Southern Dry Mixed Deciduous Forest (SDMDF):

This vegetation type is dominated by *A. amara* and *A. excelsa* with 50% canopy cover. *L. indica* and *A. torta* are the two shrub species dominated here. The altitude varies from 330 to 400mts.

Southern Moist Mixed Deciduous Forest (SMMDF):

Chuckrasia tabularis and *Trema orientalis* are the dominant tree species found in this habitat. The shrub cover is dominated by *L. indica* and *A. torta* without any clearings. The canopy cover is 60%. The altitude ranges between 400 and 700mts.

Miscellaneous+Plantation (MISC+PL):

The Miscellaneous+Plantation Forest includes plantations such as *Tectona grandis, Tamarindus indica* and *Anogeisus latifolia* with 50% of canopy cover. The shrub cover includes *L. indica* and *A. torta.* Here also the leaf litter is good. The altitude ranges from 600 to 750 mts.

Southern Sub-Tropical Hill Forest (SSTHF):

This habitat is characterized by the presence of *T. grandis, Dalbergia latifolia* and *Pterocarpus marsupium.* The canopy cover is 70%. The understorey is dominated by *Abutilon indicum* and *Mundulea sericea. L. indica* and *A. torta* were found less distributed when compared to other habitats. The leaf litter availability is very less. The altitude ranges from 800 to 950 mts.

The Theni forest division is inhabited by elephant (*Elephas maximus*), gaur (*Bos gaurus*), sambar deer (*Cervus unicolor*), Nilgiri tahr (*Hemitregus hylocris*), spotted deer (*Axis axis*), barking deer (*Muntiacus muntjak*), mouse deer (*Tragilus meminna*), tiger (*Panthera tigris*), panther (*Panthera pardus*), common jungle cat (*Felis chaus*), southern marten (*Martes gwatkinsi*), sloth bear (*Melursus ursinus*), flying squirrel (*Sciuropterus fuscicapillus*), lion tailed macaque (*Macaca silenus*), Nilgiri langur (*Presbytis johni*), slender loris(*Loris tardigradus*) and a total of 103 bird species.

METHODS

Based on the pilot survey, intensive study areas were chosen in Gudalur range and Meghamalai range, Theni Forest division, Tamilnadu to find out the Distribution, status ands relative abundance of Grey junglefowl. The Line Transect Method (Burnham *et al*, 1980) was adopted for estimating the Grey junglefowl abundance. 30 line transects of 1 km length covering different vegetation types (habitats) such as Southern Deciduous Scrub Forest (4 transects), Southern Dry Mixed Deciduous Forest (6 transects), Southern Moist Mixed Deciduous Forest (10 transects), Miscellaneous+Plantation Forest (7transects) and Southern Sub-Tropical Hill Forest (3 transects) were selected. 15 transects were laid in each of the selected intensive study areas viz., Gudalur and Meghamalai. Each transect was monitored once in a month from April 1999 to March 2000. The number of Grey junglefowl sighted on a transect, sex, altitude, and habitat type were recorded. The density estimates was performed using 'DISTANCE' Software (Thomas *et al*, 1998).

RESULTS

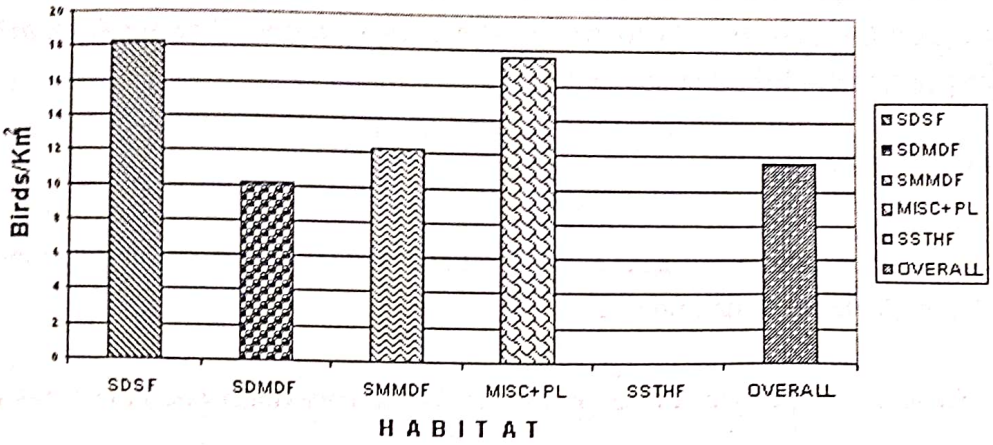
A total of 144 Grey Junglefowl were sighted during 360 transect walks. The sex ratio was 1.07:1.00 (Male: Female). The overall density estimates of Grey junglefowl in the Study Area were 11.63 birds/ km^2 (95%CI=5.43-23.33). The density of Grey junglefowl ranged from 10.16 birds/ km^2 in SDMDF habitat (95%CI=4.42-23.34) to 18.2 birds/ km^2 in SDSF habitat (95%CI=8.67-38.16) (Table 1 & Fig 2). On the other hand, there was no sighting of Grey junglefowl in SSTHF habitat.

Table1. Density estimates (Birds/km^2)for Grey Junglefowl in the Study Area during the period 1999-2000.

Habitat Types	Density(Birds/km^2)	DLCL	DUCL
SDSF	18.2	8.67	38.16
SDMDF	10.16	4.42	23.34
SMMDF	12.22	6.40	23.32
MISC+PL	17.59	9.96	31.09
SSTHF	0	0	0
Overall	11.63	5.43	23.33

DLCL = Density Lower Confidence Level (95%)
DLCL = Density Upper Confidence Level (95%)

Fig 2. Density estimates for Grey Junglefowl in the Study Area during the period 1999-2000



DISCUSSION

From the present investigation we found that the Grey junglefowl densities were maximum in SDSF and MISC+PL habitats. The SDSF habitat seems to be an ideal habitat for Grey junglefowl because of the existence of Kusum (*Schleichera oleosa)* trees with the dense *Lantana* and *Acacia* bushes. These bushes are ideal for resting, nesting and as escape cover. These habitats provide a good leaf litter with abundant insect fauna. SDSF forests due to the existence low canopy cover, moderate shrub cover and low litter depth interspersed with clearings. The absence of sighting in the subtropical hill forest may be due to high altitude, dense canopy cover and low *Lantana* and *Acacia* bushes though other shrubs exists with good density. The other reason may be due to the less availability of leaf litter. Similarly in Periyar Tiger Reserve, Grey junglefowl have been sighted frequently near human inhabitation but they are absent or rare in the high hill (Zacharias, 1997).It has been reported by Johnsgard (1986) that the Grey junglefowl inhabits a wide variety of habitats, from secondary dry deciduous to moist evergreen forests, but is especially common in bamboo thickets, edges of village forests, around cultivated fields and abandoned clearings or neglected plantations. It was primarily because the shrub layer provides protection from predators (escape cover) and shade, while litter and grass layers determined the invertebrate abundance, which are food items of Grey junglefowl.

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Distribution of Phasianid Species in Selected Areas of Tamil Nadu, India

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ABSTRACT

The indiscriminate use of land for developmental activities has threatened most of the vulnerable species of birds. The land dwelling birds are among the first one to be affected from human developments. During the course of developmental activities, natural populations get fragmented and consequently, the future existence of the populations remains uncertain. Conservation of the existing populations of ground dwelling avifauna of India is a matter of serious concern. Identifying the present status of distribution is the key factor for conservation of any species. A large number of avian studies are confined to the Protected Areas (PAs), while the study of the manipulation zones has generally been neglected. We realized the need for such information for areas outside the PA network and the present study deals with the distribution and diversity of the Family Phasianidae that includes the economically important ground dwelling birds. Eight species of Galliformes were recorded from seven different Ecotopes across 40 surveyed areas. Further results are presented and discussed.

INTRODUCTION

Systematic studies on the birds were initiated by Linnaeus himself as early as 1758. In the following years there was an explosion of knowledge (Blanford, 1898; Baker and Inglis, 1930; Ali, 1942; Ripley, 1961; Johnsingh and Murali, 1978 and Ali and Ripley, 1980). Ali and Ripley (1980) provided much needed information on the natural distribution of Phasianidae in India. The fast development of the nation has led to fragmentation of the populations of land dwelling species of birds. For recording the current distribution of these Phasianid birds, extensive surveys were conducted in the biodiversity rich arid districts of Tamil Nadu.

METHODS

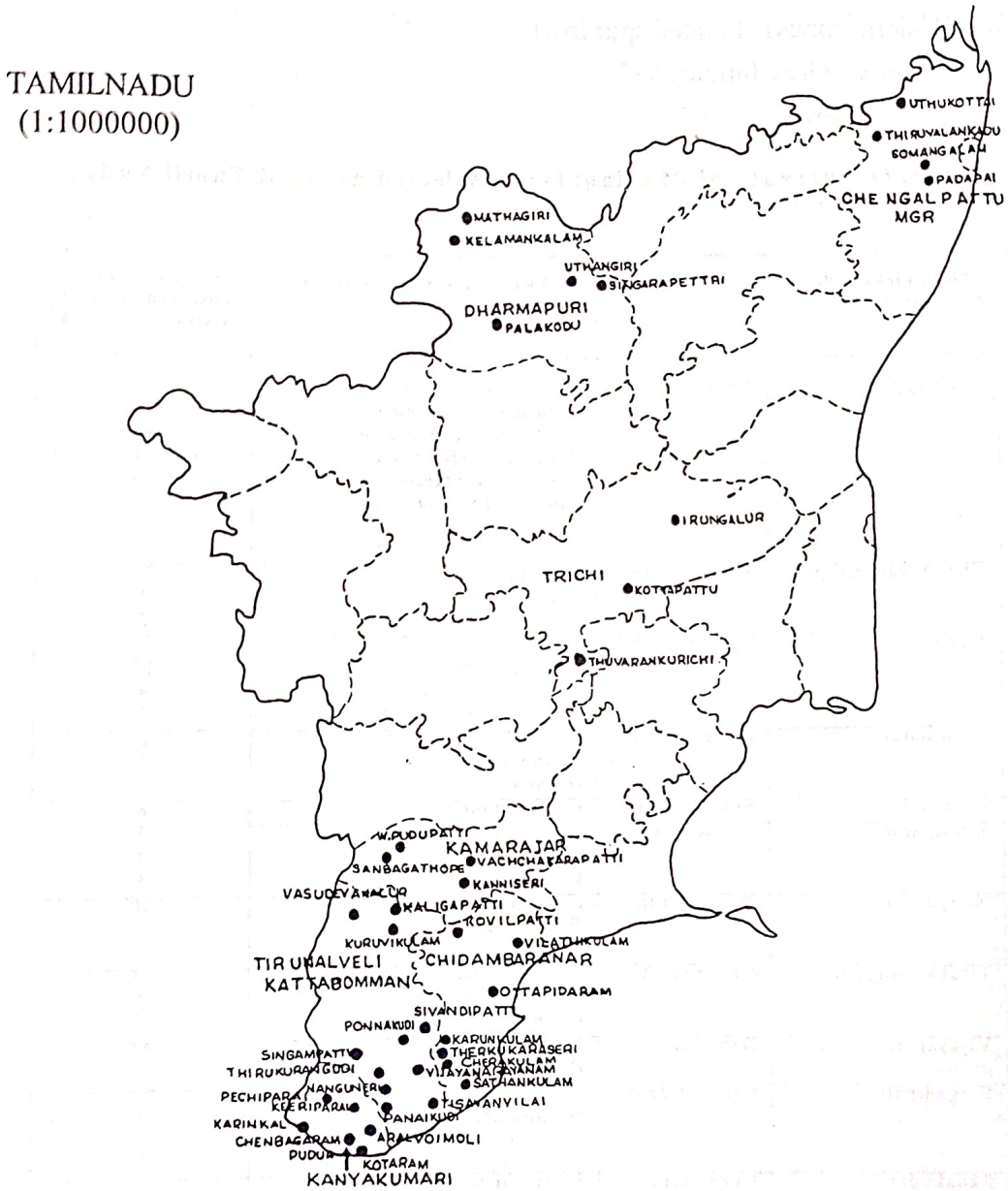
Extensive surveys were undertaken during 1994 to 1995 in Kanyakumari, Tirunelveli Kattabomman, Chidambaranar, Kamarajar, Tiruchi, Dharmapuri and Chengalpattu MGR districts of state of Tamil Nadu, India. Surveys were conducted using (8 X 30) Carl Zeiss binoculars and the birds were identified using field keys from earlier literature. The assistance of local people and the gypsies or Narikoravas who were well versed with these birds was sought. The identification of the birds was confirmed by examining the Madras Museum specimens of Phasianidae and the Bombay Natural History Society

Collection, Mumbai. The birds were observed closely in the reserve forest areas of Srivilliputhur and the identifications were further confirmed. At the end of the study, the occurrence of nine species of Phasianidae from 40 places was confirmed (Table I, Map I).

TABLE I Selected Survey Areas and their Ecotype

S.No.	Name of District & Taluk	Town/Firka/Village Selected for study	Ecotype
1.	**Kanniyakumari**		
	Thovala	Aralvaymoly	Rocky scrub
		Chenbagaramanpudur	Sparse scrub
	Agastheeswaram	Kottaaram	Sparse scrub
	Vilavancode	Karinkal	Sparse scrub
	Kalkulam	Pechiparai	Dense forest
		Keeriparai	Dense forest
2.	**Tirunelveli Kattabomman**	Nanguneri	Dense scrub
	Nanguneri	Tirukkurungudi	Dense scrub
		Vijajanarayam	Dense scrub
	Ambasamudram	Singampatti	Sparse forest
	Radhapuram	Panakudi	Dense scrub
		Thisayanvilai	Dense scrub
	Palayamkottai	Ponnakkudi	Dense scrub
		Sivndipatti	Dense scrub
	Sankaranayanarkoil	Kalingapatti	Sparse forest And grass land
	Sivagiri	Kuruvikulam	Sparse forest
		Vasudevanallur	Sparse scrub And grass land
3.	**Chidambaranar**	Kovilpatty	Dense scrub
	Kovilpatti	Sathankulam	Dense scrub
	Sathankulam	Karungulam	Dense scrub
	Srivaikuntam	Therkukaraseri	Dense scrub
		Cherakulam	Dense scrub
	Vilattikulam	Vilattikulam	Sparse scrub
		Ottapidaram	Dense scrub
4.	**Kamarajar**		
	Virudhunagar	Kanniseri	Dense scrub
		Vachchakkarapatti	Dense scrub
	Srivilliputhur	W.Pudupatti	Sparse scrub
		Sambagathoppu	Sparse forest & rocky site
5.	**Tiruchi**		
	Manachanallur	Irungaloor	Sparse scrub
	Tiruchi	Kottapattu	Sparse scrub
	Manaparai	Thuvarankurichi	Sparse scrub & grass land
6.	**Dharmapuri**		
	Palakodu	Palakodu	Sparse scrub & grass land
	Uttangarai	Uttangarai	Dense scrub
		Singarapettai	Sparse forest
	Hosur	Kelamangalam	Sparse forest
		Mathagiri	Dense forest
7.	**Chengalpattu M.G.R**		
	Sriperumbudur	Somangalam	Sparse scrub
		Padapai	Sparse scrub
	Tiruttani	Tiruvalangadu	Sparse scrub
	Uthukottai	Uthukottai	Sparse scrub

MAP I. SELECTED STUDY AREAS IN TAMILNADU



RESULTS

Extensive surveys in the 40 selected areas (Table II) confirmed the occurrences of nine species of Phasianids in the selected districts. They are:

Francolinus pondicerianus (Gmelin) - Grey francolin

Coturnix coromandelica (Gmelin) - Black-breasted Quail/Rain quail

Perdicula asiatica (Latham) - Jungle bush quail

P. argoondah (Sykes) - Rock bush quail

P. erythrorhyncha (Sykes) - Painted bush quail
Galloperdix spadicea (Gmelin) - Red spur fowl
Galloperdix lunulata (Valenciennes) - Painted spur fowl
Gallus sonneratii Temminck - Grey Jungle fowl
Pavo cristatus Linnaeus - Pea fowl

TABLE II. Occurrence of Phasianidae in selected areas of Tamil Nadu.

No.	Town/Firka/Village Under study	Habitat	Phasianid species observed	Total no.of birds observed during 4 vists from 19-8-94 to 5-7-95
1.	Aralvaymoly	Rocky scrub	*Francolinus pondicerianus* *Coturnix coromandelica* *Perdicula asiatica asiatica* *Perdicula argoondah* *Perdicula erythrorhyncha* *Galloperdix spadicea* *Galloperdix lunulata*	33 6 3 4 6 4 -
2.	Chenbagaramanpudu	Sparse scrub	*F. pondicerianus* *C. coromandelia* *P. erythrorhyncha*	22 4 2
3.	Kottaram	Sparse scrub	*F. pondicerianus* *C. coromandelia* *P. erythrorhyncha*	17 4 2
4.	Pechiparai	Dense forest	*Gallus sonneratii* *G. spadicea* *G. lunulata*	6 1 5
5.	Karinkal	Sparse scrub	*C. coromandelica*	8
6.	Keeriparai	Dense forest	*G. spadicea* *G .lunulata* *G. sonneratii*	3 3 5
7.	Nanguneri	Dense scrub	*F. pondicerinanus* *P. erythrorhynca* *P. cristatus*	30 1 5
8.	Tirukkurungudi	Dense scrub	*F. pondicerianus* *P. erythrorhyncha* *C. coromandelica*	15 2 3
9.	Vijayanarayanam	Dense scrub	*F. pondiceranus* *P. erythrorhyncha*	25 2
10.	Singampatti	Sparse forest	*G. spadicea* *G. lunulata* *G. sonneratii*	4 2 3
11.	Panakudi	Dense scrub	*F. pondicerianus* *P. erythrorhyncha*	35 2
12.	Thisayanvilai	Dense scrub	*F. pondicerianus* *C. coromandelica*	30 4
13.	Ponnakudi	Dense scrub	*F. pondicerianus*	34
14.	Sivandiapatti	Dense scrub	*F. pondicerianus*	26
15.	Kalingapatti	Sparse scrub & grass land	*F. pondicerianus* *C. coromandelica* *P. erythrorhycha* *P. cristatus*	20 6 3 8
16.	Kuruvikulam	Sparse scrub	*F. pondicerianus* *C. coromandelica* *P. cristatus*	20 7 7
17.	Vasudevanallur	Sparse scrub & grass land	*F. pondicerianus* *C. coromandelica*	14 6

18.	Kovilpatti	Dense scrub	*P. cristatus* *F. pondicerianus*	2 23
19.	Sathankulam	Dense scrub	*F. pondicerianus* *P. erthrorhyncha*	13 2
20.	Karungulam	Dense scrub	*F. pondicerianus* *P. erthrorhyncha* *P. cristatus*	20 5 19
21.	Therkukaraseri	Dense scrub	*F. pondicerianus* *P. erythrorncha* *P. cristatus*	42 2 16
22.	Chercakulam	Dense scrub	*F. pondicerianus* *P. cristatus*	20 8
23.	Vilatikulam	Sparse scrub	*F. pondicerianus* *C. coromandelica* *P. cristatus*	24 6 7
24.	Ottapidaram	Dense scrub	*F. pondicerianus* *C. coromandelica* *P. cristatus*	24 2 6
25.	Kanniseri	Dense scrub	*F. pondicerianus* *P. erythrorncha* *P. cristatus*	36 5 19
26.	Vachchakkarapatti	Dense scrub	*F. pondicerianus* *P. cristatus*	26 9
27.	W.Pudupatti	Sparse scrub	*F. ponidcerianus* *P. erthrorhyncha* *P. cristatus*	9 3 6
28.	Sambagathopu	Sparse forest & Rocky site	*F. pondicerianus* *C. coromandelica* *P. erythrorhyncha* *P. asiatica* *G. lunulata* *G. sonneratii* *P. cristatus*	20 5 6 2 4 7 10
29.	Irungaloor	Sparse scrub	*F. pondicerianus* *C. coromandelica* *P. erythrorhyncha* *P. cristatus*	12 2 3 44
30.	Kottapattu	Sparse scrub	*F. pondicerianus* *C. coromandelica* *P. cristatus*	18 4 15
31.	Thuvarankurichi	Sparse scrub & grass land	*F. pondicerianus* *C. coromandelica* *P. erythrorhyncha* *P. cristatus*	15 3 3 30
32.	Palakodu	Sparse scrub & grass land	*F. pondicerianus* *C. coromandelica* *P. asiatica* *P. erythrorhyncha*	19 8 5 4
33.	Uttangarai	Dense scrub	*F. pondicerianus* *C. coromandelica* *P. asiatica* *P. erythrorhyncha*	25 2 2 4
34.	Singarapettai	Sparse scrub	*F. pondicerianus* *C. coromandelica* *P. asiatica* *P. erythrorhyncha* *P. argoondah*	12 3 2 3 3
35.	Kelamangalam	Dense forest	*F. pondicerianus* *C. coromandelica* *P. asiatica* *P. erythrorhyncha*	11 3 4 2
36.	Mathagiri	Dense scrub	*F. pondicerianus* *C. coromandelica* *P. asiatica* *G. spadicea* *G. sonneratii* *P. cristatus*	11 4 3 3 4 8
37.	Somangalam	Sparse scrub	*F. pondicerianus* *C. coromandelica* *P. erythrorchyncha*	29 3 3
38.	Padapai	Sparse scrub	*F. pondicerianus* *C. coromandelica*	12 4
39.	Tiruvalangadu	Sparse scrub	*F. pondicerianus*	39
40.	Uthukottai	Sparse scrub	*F. pondicerianus* *C. coromandelica* *P. erythrorhyncha*	36 2 4

DISCUSSION

Among the 40 areas surveyed, Aralvaymoli of Kanyakumari district, which has often been quoted in the past literature (Ferguson, 1904; Ali, 1942), proved to be a stronghold of the Phasianidae. Seven species were recorded from Aralvaymoli. It lies in between the dense forests of Mahendragiri and the scrub forests of Tirunelveli Kattabomman district. It provides an ideal habitat for local Phasianidae with characteristic semi arid conditions, dense thickets, high humidity, thick grass cover, and less human disturbance. This place may be recommended for *in situ* conservation of Phasianidae. Other places found suitable for the phasianid conservation were Kalingapatti (Tirunelveli Kattabomman District), Irungaloor (Tiruchi District) and Thuvarankurichi (Tiruchi District). All the five selected areas from Dharmapuri supported four species of phasianids.

Of the nine species recorded during present study Grey francolin was identified as the most common species. *C. coromandelica*, the Black-breasted or Rain quail, which occurred in 23 places seems to be a successful species. *P. erythrorhyncha*, Painted bush quail was also recorded from 21 places. *P. asiatica*, the Jungle bush quail was recorded from seven places, in forested areas. *Pavo cristatus* was widely distributed; occurring in 18 places. However, this artificial protection that they enjoy due to the religious sentiments and as a national bird cannot be treated in par with the other species.

Gallus sonneratii frequents dense forest areas and was found in five places. This species, once reported to be very common was observed in very small numbers. *G. spadicea* and *G. lunulata* occurred together in the edges of forests and rocky terrain. They were located with difficulty during the present study as they inhabit dense and thorny cover along the outskirts of forests. As the study pertains to manipulation zones of semi arid habitats their distribution needs further confirmation among forest areas. *P. argoondah* occurred in only two places. Even in earlier literature their scarcity in the Southern Peninsula has been reported (Baker and Inglis, 1930). While all the nine species of this study require constant monitoring and attention, *G. lunulata* and *G. spadicea* needs to be conserved with special attention.

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A note on the capturing techniques used by villagers and domestication of Grey francolin, *Francolinus pondicerianus pondicerianus* in Southern Tamil Nadu.

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ABSTRACT

The birds of culinary value were cherished by human society and domesticated from time immemorial. Despite the large scale production by poultry industry and availability of domesticated birds in village farms, poaching of wild galliformes for meat still continues. The Grey francolin is one of the commonly poached species in Southern Tamil Nadu. Methods of poaching and the traps used for the purpose are discussed. Domestication of Grey francolin was observed in the villages during 1994-1995. The urgent need to involve the local population in conservation programmes is emphasized.

INTRODUCTION

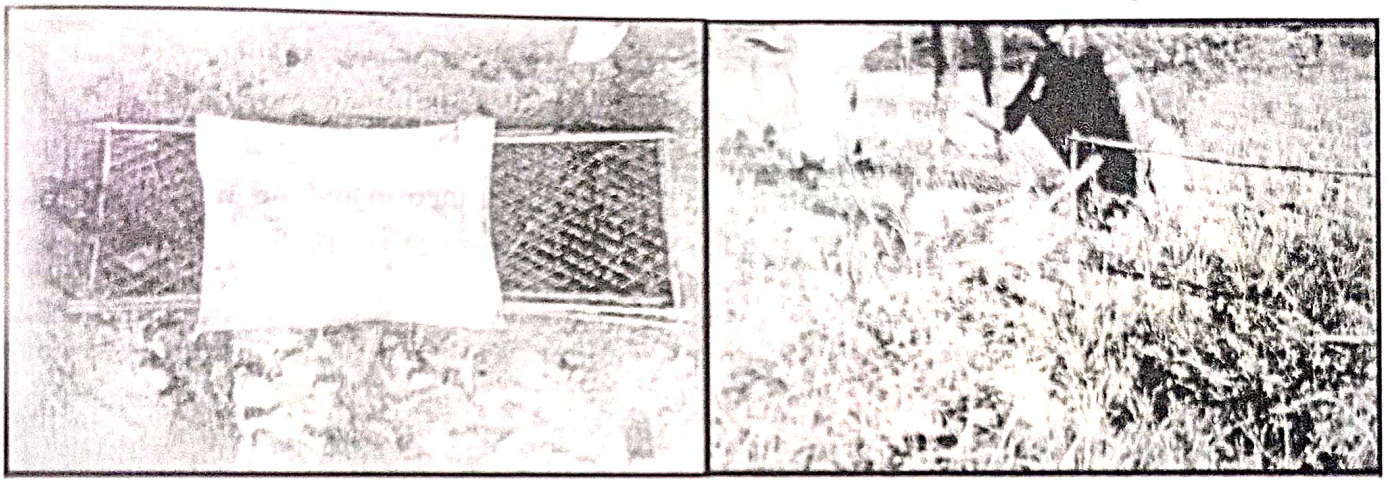
Farm produced domesticated birds never satisfy the human desire to hunt and taste the wild birds that are relished as table delicacy. The illegal hunting of Grey francolin, *Francolinus pondicerianus pondicerianus* continues in spite of severe measures taken by the authorities. Poachers are either the local people of the village or the gypsies(Narikoravas) who come there to hunt these birds in large numbers. As Grey francolin are palatable game birds they are actively hunted upon for food and for monetary benefits. The trapping of these birds have a long history in Tamil Nadu and many traditional methods have been employed by the people. Several techniques are followed by the trappers both professional as well as local people. Professionals are people who come there with air rifles to shoot these birds and the gypsies use traps made by them. Giles(1984) has described drive and drift traps to capture Grey francolin.

METHODS

The local village people locate the feeding patches of these birds where they occasionally sift through the sand for food. They spread ragi and the pearl millet, mixed with burnt ash the smell of which they say attract the Grey francolin. At these feeding patches small baits which tie around the bird's legs are kept. When the birds come to feed on these ragi and pearl millet their legs get entangled in the baits and they are caught.

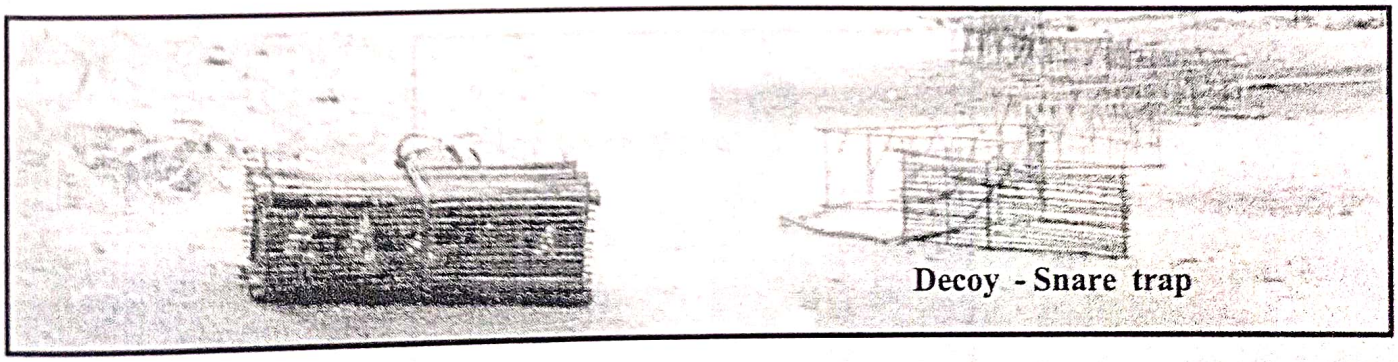
Drive and snare trap method was followed by the gypsies who capture these birds. The trappers use a head gear resembling a cow's hump and have a cow along side them. While the cow is grazing the man with the head gear is indistinct and the birds unaware of the presence of a human being is feeding near the cow. The trapper locates the birds and then scatters them towards a particular region where a hand made net has been tied on. The birds fall on that net in large numbers and get caught.(Plate-1)

Plate I Traps used by Poachers to catch *F.P. Pondicerianus*



Drive Snare Trap

In Decoy-snare trap method the trapper has a male Grey francolin which has been domesticated by them. This method of trapping is employed during breeding season, when the domesticated males are used as decoys to attract the females of the species. The trained decoy male starts its mating call which attracts the female birds from the surrounding areas. Sometimes the trappers themselves produce the call like a decoy male to attract other birds. Near the decoy, snare traps are placed vertically. Each trap is made of sticks and nooses in which the female birds get caught in their neck or legs(Plate-2)



Decoy - Snare trap

The noose traps consist of about 100 wooden sticks, approximately 20 cm in length and about 1 cm in diameter, each with a thin nylon noose attached to a cotton string, with about 20 cm separating one stick from next . To deploy these traps the sticks are struck into the ground at an angle leaving about 15 cm of each stick and the 10-15 cm nylon noose protruding at a 45 degree angle to the ground. The sticks could be arranged in a straight line on in a zig-zag pattern or in a semicircle depending on the vegetation cover in the ground.

DISCUSSION

Large number of Grey francolin are trapped in this manner. Many times trappers were intercepted in their process and one was found to have trapped 76 Grey francolin at one time. They were being taken to the local town market where a pair would be sold at Rs.40/- . Capturing these birds in large number would have a drastic effect on the population as a whole. Stringent action is needed to curb these trappers.

In spite of this heavy poaching, Grey francolin has well adapted itself to the semi-arid conditions of our state and today they occur around human habitations. It has been domesticated by the local people (Plate-3) who rear them in their homes either as pets or for fighting purposes or as decoys to capture birds of the same species. They collect eggs from nests of Grey francolin and incubate them under broody hen and rear them in their houses (Plate-4). It was interesting to watch a domesticated male (Plate-3)

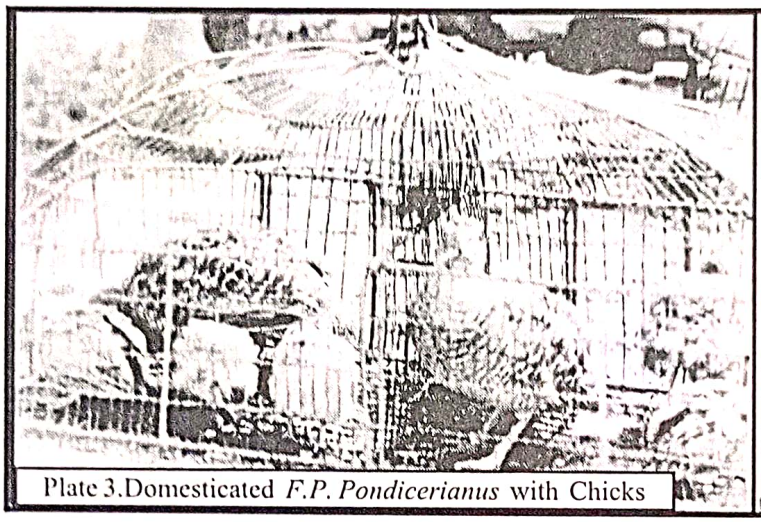
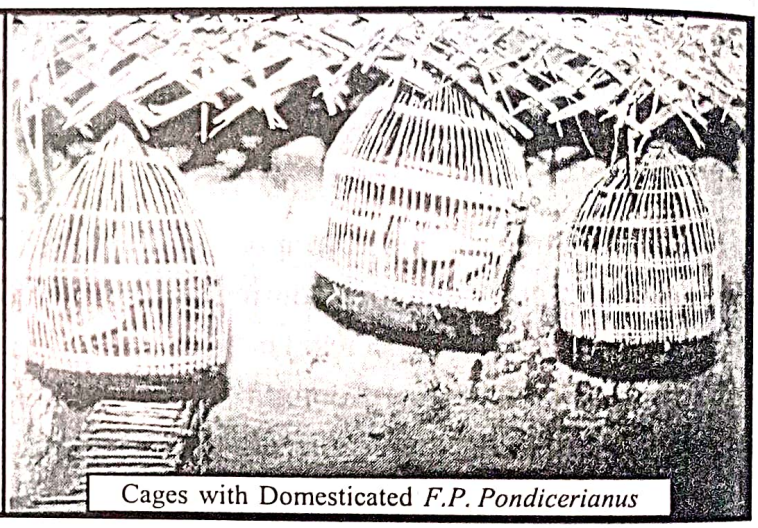


Plate 3.Domesticated *F.P. Pondicerianus* with Chicks



Cages with Domesticated *F.P. Pondicerianus*

Plate 4. *F.P. Pondicerianus* chicks with domestic hen mother

Grey francolin reared for fighting purposes responding to its owner's call and moving with him freely. Males of this species were bred for fighting purposes since francolin fights are popular sport to the local people, where large sums of money are used as bets (Plate-5)

Plate 5. Domesticated male *F.P. Pondicerianus* engaged in fights

Grey francolin could be domesticated for commercial purposes. The Japanese breeders have domesticated Japanese quail, *Coturnix coturnix japonica* from an original wild song quail around 1910(Kawahara, 1973;1978). The commercial success of this japanese quail introduced into India as a table variety remains expensive and out of reach to poor villagers. So to meet the growing demands of the public in India at cheaper rate our own hardy endemic species, Grey francolin can be domesticated at a commercial level and introduced to the Indian market. Their hardy nature and highly adaptive characters like better body weight, short generation interval, higher egg production rate, more disease resistance, capacity to withstand arid conditions make it a better choice for domestication and commercialization on a large scale.

Illegal hunting and poaching of these birds in large numbers could be drastically reduced if a domesticated variety of Grey francolin gets introduced into the market. The villagers and gypsies who are involved in poaching could be taught about breeding these domesticated varieties in their uncultivable lands where they could feed them with the local food available in the environment. Thus the cost of production could be made less and they would not compete with other poultry birds whose feeding requirements are much more costly. Its remarkable adaptation of surviving with limited supply of water will help a long way in breeding them in the most backward districts in arid conditions. Further research to produce a domesticated hybrid variety should be encouraged as it is a much needed conservation measure. They may be introduced to villagers who can breed them at lower cost as cottage industry.

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Habitat Utilization by Grey Junglefowl (*Gallus sonneratii*) in Theni Forest Division, Meghamalai, Tamilnadu

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ABSTRACT

We assessed the habitat utilization pattern by Grey junglefowl (*Gallu sonneratii*) in Theni Forest Division (9°31'-10°10'N, 77°20'-77°40'E) Meghamalai, Tamilnadu from April 1999 to March 2000. Five major habitat types *viz.*,(1) Southern Deciduous Scrub Forest (SDSF), (2) Southern Dry Mixed Deciduous Forest (SDMDF), (3) Southern Moist Mixed Deciduous Forest (SMMDF), (4) Miscellaneous + Plantation Forest (MISC+PL) and (5) Southern Sub-Tropical Hill Forest (SSTHF) were identified in the Study Area. A total of 88 records of Grey junglefowl were made and incidentally, the SSTHF which represent hill forest had only one sighting. Habitat use analysis performed using Neu *et al.* (1974) analysis revealed significantly higher use (preferred) of SMMDF relative to its availability, while MISC+PL was used less than its availability (avoided). The habitat SDSF and SDMDF were utilized in proportion to availability. There were seasonal differences in the habitat use by Grey junglefowl, showing preference to SMMDF and SDMDF in summer and pre-monsoon respectively. Irrespective of seasons, the Grey junglefowl used moderate shrub cover (41-60%), low grass cover (21-40%) and low litter cover (21-40%) with higher litter depth (>5cm). It appears that canopy cover and tree number do not have any direct significant influence on Grey junglefowl habitat use. The result indicate that choice of habitat by Grey junglefowl largely depends on the interspersion of moderate shrub cover (41-60%), low litter cover (<40%), high litter depth (>5cm) and low grass cover (<40%). It was primarily because the shrub layer provides protection from predators (escape cover) and shade, while litter and grass or herb layers determined the invertebrate abundance, which are food items of Grey junglefowl.

INTRODUCTION

The grey or Sonnerat's junglefowl is one of the four species in the genus *Gallus*, species *sonneratii* which is truly endemic to southern India. Its distribution is confined to peninsular India which extends up to Mount Abu in Rajasthan in the North. Occurring from sea level to 5000 feet, it inhabits evergreen as well as shrub, bamboo, teak and mixed forests (Johnsgard, 1986). The Grey junglefowl has received little attention and although its numbers may be high in certain areas, it has been reported that there is an overall decline in its numbers (Coote, 1992). The Grey junglefowl is considered as one of the near-threatened species, with a fragmented range (Fuller and Garson, 2000). The World Pheasant Association India has also formulated a conservation strategy for Grey junglefowl. In it they suggested undertaking an intensive study of their status, distribution, ecology and behaviour so as to prepare an

effective management plan. The Grey junglefowl acts as a good indicator species. The World Pheasant Association regards Grey junglefowl as an important species for study because it has shown decreasing trends over the last few decades. During the Wynad bird survey, Zacharias (1993) found only few numbers of Grey junglefowl, than expected. He informed that, for conserving this species, efficient management is essential which has to be supported by an in-depth research. Kaul and Garson (1992) reported that there is very little survey information to help in the conservation of Grey junglefowl. Habitat utilization by Grey junglefowl in the north western parts of Bori Wildlife Sanctuary; Madya Pradesh have been reported by Tata and Gautam (1992). Zacharias (1997) has presented a brief account on the status of Grey juglefowl in Periyar Tiger Reserve (PTR), Kerala. Singh (1995) proposed that a thorough investigation is required in order to determine the current status of Grey junglefowl. In view of the aforesaid facts a study has been taken up to find out the habitat utilization of Grey junglefowl. This paper describes habitat utilization by Grey junglefowl based on sightings from transect surveys in five different habitats in Theni Forest Division.

STUDY AREA

The Theni Forest Division (9°31'-10°10'N, 77°20'-77°40'E) is located in Theni district, Tamilnadu. This area forms part of the Western Ghats and it is located on the boundary of Tamilnadu and Kerala State (Fig:1). This forest covers an area of 723 sq.km. It comprises of Bodi range, Cumbum range, Gudalur range and Meghamalai range (Fig.1). The elevation ranges from 300 m to 1550m. The rainfall varies between 700mm and 2000mm. The important rivers are Periyar, Suruliyar, and Vaigai. The vegetation types (habitats) include Southern Deciduous Scrub Forest, Southern Dry Mixed Deciduous Forest, Southern Moist Mixed Deciduous Forest, Miscellaneous+plantation Forest and Southern Sub-Tropical Hill Forest.

Southern Deciduous Scrub Forest (SDSF):

The habitat with 50% of canopy cover is characterized by the presence of the dominant tree species such as *Schleichera oleosa*, *Albizzia amara*, *Ailanthus excelsa* and *Aacia chundra*. The shrub cover is dominated by *Lantana camera* and *Acacia torta* interspersed with numerous small clearings with lot of litter availability. The altitude ranges from 325 to 350 mts.

Southern Dry Mixed Deciduous Forest (SDMDF):

This vegetation type is dominated by *A. amara* and *A. excelsa* with 50% canopy cover. *L. indica* and *A. torta* are the two shrub species dominated here. The altitude varies from 330 to 400mts.

Southern Moist Mixed Deciduous Forest (SMMDF):

Chuckrasia tabularis and *Trema orientalis* are the dominant tree species found in this habitat. The shrub cover is dominated by *L. indica* and *A. torta* without any clearings. The canopy cover is 60%. The altitude ranges between 400 and 700mts.

Miscellaneous+Plantation (MISC+PL):
The Miscellaneous+Plantation Forest includes plantations such as *Tectona grandis, Tamarindus indica* and *Anogeisus latifolia* with 50% of canopy cover. The shrub cover includes *L. indica* and *A. torta.* Here also the leaf litter is good. The altitude ranges from 600 to 750 mts.

Southern Sub-Tropical Hill Forest (SSTHF):
This habitat is characterized by the presence of *T. grandis, Dalbergia latifolia* and *Pterocarpus marsupium.* The canopy cover is 70%. The understorey is dominated by *Abutilon indicum* and *Mundulea sericea. L. indica* and *A. torta* were found less distributed when compared to other habitats. The leaf litter availability is very less. The altitude ranges from 800 to 950 mts.

The Theni forest division is inhabited by elephant (*Elephas maximus*), gaur (*Bos gaurus*), sambar deer (*Cervus unicolor*), Nilgiri tahr (*Hemitregus hylocris*), spotted deer (*Axis axis*), barking deer (*Muntiacus muntjak*), mouse deer (*Tragilus meminna*), tiger (*Panthera tigris*), panther (*Panthera pardus*), common jungle cat (*Felis chaus*), southern marten (*Martes gwatkinsi*), sloth bear (*Melursus ursinus*), flying squirrel (*Sciuropterus fuscicapillus*), lion tailed macaque (*Macaca silenus*), Nilgiri langur (*Presbytis johnii*), slender loris(*Loris tardigradus*) and a total of 103 bird species.

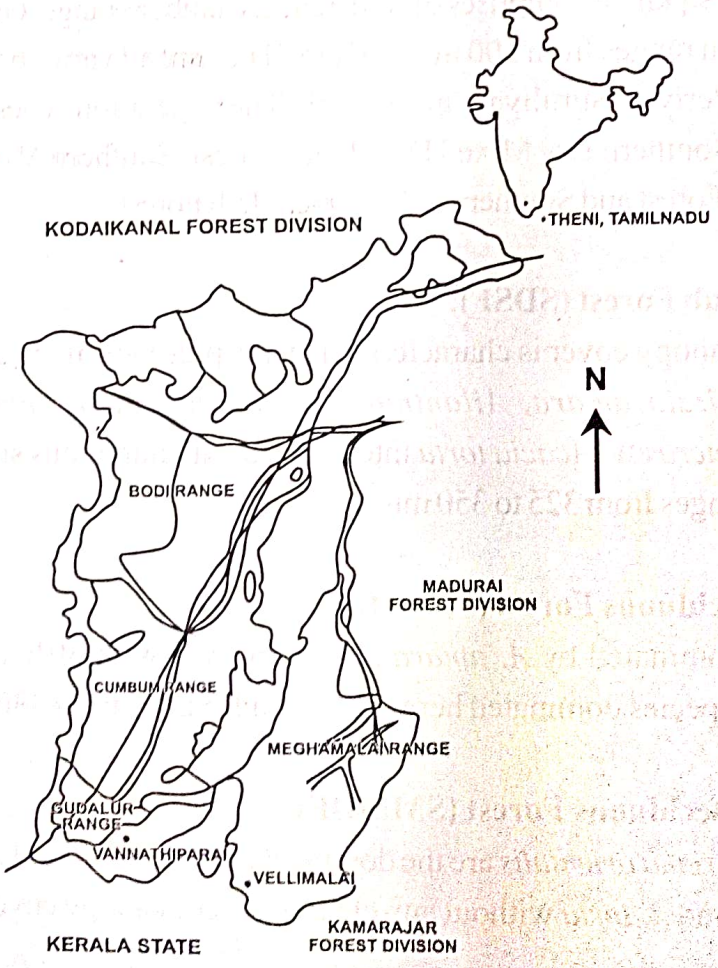


Fig. 1 Map showing study area in the Theni Forest Division

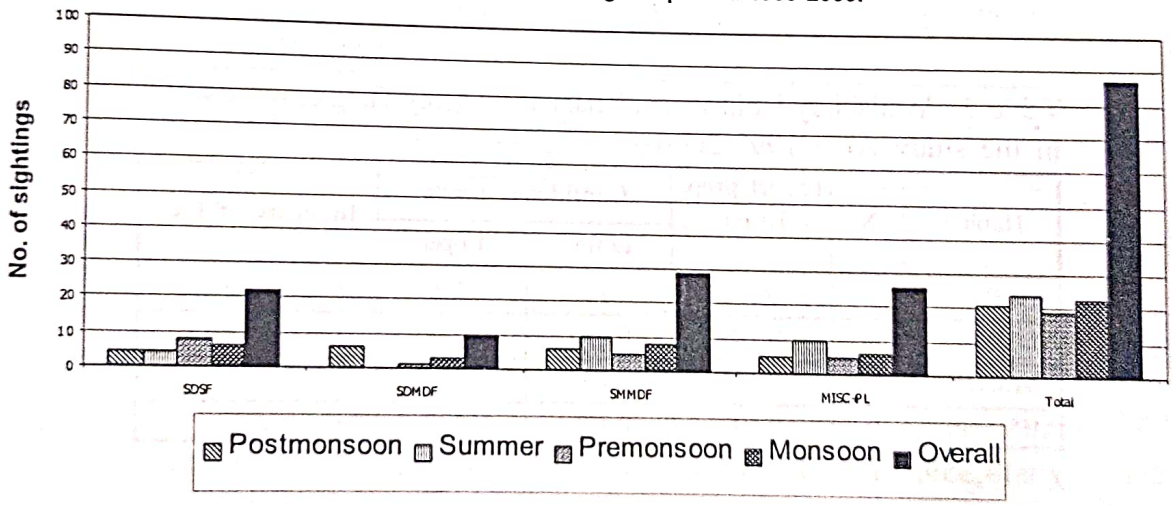
METHODS

Based on the pilot survey, intensive study areas were chosen in Gudalur range and Meghamalai range, Theni Forest division, Western Ghats, Tamilnadu, south India to find out the habitat utilization by Grey junglefowl. The Line Transect Method (Burnham *et al*, 1980) was adopted for estimating the Grey junglefowl abundance. 30 line transects of 1 km length covering different vegetation types (habitats) such as Southern Deciduous Scrub Forest (4 transects), Southern Dry Mixed Deciduous Forest (6 transects), Southern Moist Mixed Forest (10 transects), Miscellaneous+Plantation Forest (7transects) and Southern Sub-Tropical Hill Forest (3 transects) were selected. 15 transects were laid in each of the selected intensive study areas viz., Gudalur and Meghamalai. Each transect was monitored once in a month from April 1999 to March 2000. The number of Grey junglefowl sighted on a transect, sex, altitude, and habitat type were recorded. Habitat use analysis (Neu *et al.* 1974) was performed using 'PREFER' Software (Prasad & Gupta 1992). To find out the significant differences in the sightings among different habitats and seasons, the Chi-square test was used (Seigel, 1956). The microhabitat variables were analysed by using the Ivlev`s Index of selectivity (Ivlev, 1981).

RESULTS

A total of 88 (Fig 2) Grey junglefowl records (sightings) were sighted from all the habitats in different seasons during the study period. The highest sighting was occurred in SMMDF habitat incidentally the SSTHF, which

Fig. 2: Grey Junglefowl sightings (N) in different habitats and seasons in the Study Area during the period 1999-2000.



represent hill forest, had only one sighting. Habitat use analysis performed using Neu *et al.* (1974) revealed significantly higher use (preferred) of SMMDF relative to its availability, while MISC+PL was used less than its availability (avoided). The habitat SDSF and SDMDF were utilized in proportion to availability (x^2 =14,359, df=6,P<0.05) (Table 3). There were seasonal differences in the habitat use by Grey junglefowl, showing preference to SMMDF and SDMDF in summer (x^2 =11,998, df=3,P<0.01) and premonsoon (x^2 =8,156, df=3, P<0.05) respectively (Table 1 & 2). Irrespective of

Table1. Availability-Utilization of habitat by Grey Junglefowl (N=24) in Summer

Habitat	N	Expect prop. Usage	Confidence limits		Intensity of Use
			Lower	Upper	
SDSF	4	0.196	0	0.357	Used in prop.
SDMDF	0	0.185	0	0	Avoided
SMMDF	10	0.121	0.165	0.668	Preferred
MISC+PL	10	0.497	0.165	0.668	Used in prop.

χ^2=11.998, df=3, P<0.01

Table 2. Availability-Utilization of habitat by Grey Junglefowl (N=19) in Premonsoon

Habitat	N	Expect prop. Usage	Confidence limits		Intensity of Use
			Lower	Upper	
SDSF	8	0.196	0.138	0.704	Used in prop.
SDMDF	1	0.185	0	0.181	Avoided
SMMDF	5	0.121	0.011	0.516	Used in prop.
MISC+PL	5	0.497	0.011	0.516	Used in prop.

χ^2=8,156, df=3, P<0.05

Table 3. Availability-Utilization of habitat by Grey Junglefowl (N=87) in the study Area 1999-2000

Habitat	N	Expect prop. Usage	Confidence limits		Intensity of Use
			Lower	Upper	
SDSF	22	0.196	0.136	0.399	Used in prop.
SDMDF	10	0.185	0.029	0.2	Used in prop.
SMMDF	29	0.121	0.207	0.46	Preferred
MISC+PL	26	0.497	0.176	0.422	Avoided

χ^2=14,359, df=6, P<0.05

seasons, the Grey junglefowl used moderate shrub cover (41-60%) (Table 5), low grass cover (21-40%) (Table 6) and low litter cover (21-40%) (Table 7) with higher litter depth (>5cm) (Table 8). It appears that canopy cover (Table 4) and tree number (Table 9) do not have any direct significant influence on Grey junglefowl habitat use. The results indicate that choice of habitat by Grey junglefowl largely depends on the interspersion of moderate shrub cover (41-60%), low litter cover (<40%), high litter depth (>5cm) and low grass cover (<40%).

Table 4. Use of canopy (%) in different seasons in the Study Area during the period 1999-2000

Season	Use of canopy cover (%) Categories		χ^2	df	P
	I <40%	II >41%			
Postmonsoon	57	43	0.428	1	P>0.05 *
Summer	83	17	10.666	1	P<0.01
Premonsoon	74	26	4.262	1	P<0.05
Monsoon	42	58	0.666	1	P>0.05 *

Chi square test * Significant χ^2=10.309, df=3,P<0.02

Table 5. Use of shrub cover (%) in different seasons in the Study Area during the period 1999-2000

Season	Use of shrub cover (%) Categories		χ^2	df	P
	I <40%	II >41%			
Postmonsoon	29	71	3.856	1	P<0.05
Summer	21	79	8.166	1	P<0.01
Premonsoon	32	68	2.578	1	P<0.20
Monsoon	12	88	13.5	1	P<0.001

χ^2=2.782, df=3, P>0.05

Table 6. Use of grass cover (%) in different seasons in the Study Area during the period 1999-2000

Season	Use of grass cover (%) Categories		χ^2	df	P
	I <40%	II >41%			
Postmonsoon	81	19	8.046	1	P<0.01
Summer	100	0	24	1	P<0.001
Premonsoon	100	0	19	1	P<0.001
Monsoon	92	8	16.666	1	P<0.001

χ^2=9.366, df=3, P<0.05

Table 7. Use of litter cover (%) in different seasons in the Study Area during the period 1999-2000

Season	Use of litter cover (%) Categories		χ^2	df	P
	I <40%	II >41%			
Postmonsoon	67	33	2.541	1	P>0.20
Summer	21	79	8.166	1	P<0.01 *
Premonsoon	21	79	6.368	1	P<0.02 *
Monsoon	25	75	6	1	P<0.02 *

χ^2=14.333, df=3, P<0.01

Table 8. Use of litter depth (cm) in different seasons in the Study Area during the period 1999-2000

Season	Use of litter depth (cm) Categories		χ^2	df	P
	I <4cm	II >5cm			
Postmonsoon	86	14	10.114	1	P<0.001 *
Summer	42	58	0.666	1	P>0.05
Premonsoon	73	27	4.262	1	P<0.20 *
Monsoon	100	0	24	1	P<0.001

χ^2=14.333, df=3, P<0.01

Table 9. Use of tree number in different seasons in the Study Area during the period 1999-2000

Season	Use of tree number Categories		χ^2	df	P
	I <4n	II >5n			
Postmonsoon	67	33	2.332	1	P<0.02 *
Summer	54	46	0.166	1	P>0.05
Premonsoon	53	47	0.052	1	P>0.05
Monsoon	62	38	1.5	1	P>0.05

χ^2=1.14 df=3, P>0.05

DISCUSSION

Habitat use analysis revealed significantly higher use (preferred) of SMMDF relative to its availability, while MISC+PL was used less than its availability (avoided). The habitat SDSF and SDMDF were utilized in proportion to availability. The dense *Lantana* and *Acacia* bushes are ideal for resting, nesting and as escape cover. It seems that they used SMMDF habitat, which had low canopy cover, and also moderate shrub cover interspersed with clearings. Moreover, this habitat provides a good leaf litter with abundant insect fauna. SDSF forest due to the existence of low litter depth the Grey junglefowl used in proportion to availability. MISC+PL habitat is more open but low shrub cover with low litter depth is a major reason for avoidance. The low sightings in the subtropical hill forest may be due to high altitude, dense canopy cover and low *Lantana* and *Acacia* bushes though other shrubs exists with good density. The other reason may be due to the less availability of leaf litter. Similarly in Periyar Tiger Reserve, Grey junglefowl have been sighted frequently near human inhabitation but they are absent or rare in the high hill (Zacharias, 1997).It has been reported by Johnsgard (1986) that the Grey junglefowl inhabits a wide variety of habitats, from secondary dry deciduous to moist evergreen forests, but is especially common in bamboo thickets, edges of village forests, around cultivated fields and abandoned clearings or neglected plantations. It appears that canopy cover and tree number do not have any direct significant influence on Grey junglefowl habitat use. The result indicates that choice of habitat by Grey junglefowl largely depends on the interspersion of moderate

shrub cover (41-60%), low litter cover (<40%), high litter depth (>5cm) and low grass cover (<40%). It was primarily because the shrub layer provides protection from predators (escape cover) and shade, while litter and grass or herb layers determined the invertebrate abundance, which are food items of Grey junglefowl.

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Roosting Tree Selection by Grey Junglefowl, (*Gallus sonneratii*) in Alagar Koil Valley, Srivilliputtur Grizzled Giant Squirrel Sanctuary, Kamarajar District, Tamil Nadu

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ABSTRACT

Roost site selection by the Grey junglefowl (*Gallus sonneratiii*) was studied at Alagar Koil Valley, (9° 33´ to 9° 36´N, 77° 33´ to 77° 35´E) of Srivilliputtur Grizzled Giant Squirrel Sanctuary, Kamarajar District, Tamil Nadu from December 1993 to March 1994. We found that seven tree species were preferred for roosting by the Grey junglefowl in the study area. Though, the roost tree use was variable, majority of the birds utilized *Mangifera indica* (36.14%) and *Bambusa* sp. (30.12%) for roosting. The proportional use of tree species such as *Salmalia malabarica, Spondius mangifera* and *Strebulus asper* was very low with just 1.2%. The roost trees with a height of 8-20cm were preferred for roosting.

INTRODUCTION

Trivedi and Johnsingh (1994) reported that roost selection is a vital component in the overall habitat selection process. Information on roost selection by a bird species is of great importance in planning for its conservation. Hillgarth (Pers.com) also suggested that it would be interesting to study the Grey junglefowl distribution related to the availability of suitable roosting trees. The present study is on the trees preferred for roosting by the Grey junglefowl in Alagar Koil Valley, Srivilliputtur Grizzled Giant Squirrel Sanctuary, Kamarajar District, Tamil Nadu. A perusal literature shows that no previous information is available about trees preferred by the Grey junglefowl for roosting.

STUDY AREA

The present study was carried out in Srivilliputtur Grizzled Giant Squirrel Sanctuary, Srivilliputtur, Tamilnadu. It lies between 9° 33' to 9° 36'N latitude and 77° 33' to 77° 35'E longitude. The vegetation differs from thorn forest to dry deciduous, moist deciduous, semi evergreen and evergreen. This study area is inhabited by a good number of birds like Black eagle (*Ictinaetus malayensis*), Crested hawk eagle (*Spizaetus cirrhatus*), Rufousbellied hawk eagle (*Hieraatus kinerii*), Redwinged crested cuckoo (*Clamater coromandus*), Brown fish-owl (*Bubo zeylonensis*), Malabar grey hornbill (*Toku griseus*), Malabar pied hornbill (*Anthracoceros*

coronatus), Great pied hornbill (*Buceros bicornis*), Blue peafowl (*Pavo crstatus*), Red spurfowl (*Galloperdix spadicea*), Grey quail (*Coturnix coturnix*) and Grey partridge *(Francolinus pondicerianus*).

Mammals found distributed in the study area are: The common langur (*Presbytis entellus*), bonnet macaque (*Macaca radiata*), slender loris (*Loris tardigradus*), Nilgiri langur (*Presbytis johnii*), mouse deer (*Tragulus meminna*), barking deer (*Munticus muntjak*), chital (*Axis axis*), sambar deer (*Cervus unicolor*), wild pig (*Sus scrofa*), gaur (*Bos gaurus*),elephant (*Elephas maximus*),grizzled giant squirrel (*Ratufa macroura*), Indian civet (*Viverricula indica*), toddy cat (*Paradoxurus hermaphroditus*), jungle cat (*Felis chaus*), leopard (*Panthera pardus*), tiger (*Panthera tigris*), sloth bear (*Melursus ursinus*) and dhole (*Cuon alphinus*).

METHODS

We counted the Grey junglefowl at their roosting sites at dusk and dawn, as suggested by Sharma (1979). The tree height and roost height were recorded. Each roost tree was marked suitably with paints.

RESULTS

In Srivilliputtur Grizzled Giant Squirrel Sanctuary, the Grey junglefowl preferred the following seven species of trees for roosting *Bambusa arundinacea, Bauhinia racemosa, Mangifera indica, Salmalia malbarica, Spandias mangifera, Strebulus asper* and *Tamarindus indica*. A majority of the birds utilized *M. indica* (36.14%) and *Bambusa* sp (30.12%) for roosting. On the other hand, utilization of *S. malbarica* (1.20%) *S. mangifera* (1.20%) and S. *asper* (2.40%) was very low (Table 1).

Table 1: The tree species preferred for roosting by Grey junglefowl at Srivilliputur Grizzled Giant squirrel Sanctuary.

S.NO	TREE SPECIES	NO.OF TREES	NO.OF BIRDS	PERCENTAGE
1	*Bambusa arundinacea*	8	25	30.12
2	*Bauhinia racemosa*	7	16	19.27
3	*Mangifera indica*	15	30	36.14
4	*Salmalia malbarica*	1	1	1.2
5	*Spandias mangifera*	1	1	1.2
6	*Strebulus asper*	1	2	2.4
7	*Mangifera indica*	3	8	9.63

The roost trees with heights of 8-20m were preferred for roosting and in majority of the case, the roost was located between 7 to 16 m height.

DISCUSSION

The preference of *M. indica* for roosting by Grey junglefowl can be due to dense canopy cover. The preference for *B. arundinacea* may be due to the thorny nature, which gives protection to the Grey junglefowl. It can be observed that the Grey junglefowl selected trees with heights ranging mostly from 8-20mts height. The birds seem to prefer roosting height of 7-16mts. Hillgarh (Pers.com) suggested that the preference of a particular height for roosting sites may be an antipredatory strategy against nocturnal predators. Trivedi and Johnsingh (1996) also stated that the preference for the roost trees is an antipredatory strategy against nocturnal predators. These authors further opined that any tree which satisfies the structural requirements for avoiding predators may be preferred by birds for roosting. Only those tree species possess the necessary structural features of an ideal roost tree are preferred. Similarly other requirements such as height of the tree and the canopy cover might also be important in choosing the trees by Grey junglefowl for roosting. It has been reported by Lack (1954);Hill and Robertson (1988) that predation is a major population regulatory mechanism in Gallinaceous birds and therefore it may possibly influence habitat selection significantly.

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Resource utilization by the grey junglefowl *gallus sonneratii* in anaikatty hills, coimbatore

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ABSTRACT

The study was undertaken during 1999-2001in Anaikatty hills, the foothills of the Nilgiris in the Nilgiri Biosphere Reserve, Western Ghats, at an elevation of about 560-750m above mean sea level. This area situated around 76° 47'E and 11° 5' N. Mixed dry deciduous forest consists of the combination of trees such as *Acacia leucophloea, Ziziphus mauritiana, Chloroxylon swietenia, Albizia amara, Tamarindus indicus, Albizia lebbeck, Acacia polyacantha, Diospyros ferrea, Cassia fistula* and *Commiphora caudata.* Dominant shrubs available in this forest are *Chromolaena odorata, Clausena indica, Elaeodendron glaucum, Flacourtia indica, Lantana camara, Lantana wightiana, Randia dumetorum, Premna tomentosa, Pavetta indica* and *Mundulea sericea.* Succulents such as *Opuntia dillenii* and *Euphorbia antiquorum* are also commonly seen. Since many villagers are dwelling in and around this vegetation type, anthropogenic pressures form a major threat for its existence. The tribals of the surrounding villages not only collect firewood but also trap the Grey Junglefowl and collect eggs from this forest. Grey Junglefowl was recorded only from the mixed dry deciduous forest and not in the scrub forest. It is an omnivore feeding on insects, other invertebrates and grains with preference for insects and grains. It preferred predominantly to feed on the ground. When the ground was further classified into litter zone, grassy ground, herbal ground and barren ground, litter ground was highly preferred (39%) followed by barren (29%), herb (20%) and grassy (11%) ground. Method of feeding was mainly gleaning followed by probing. Feeding height was restricted to 0-1m, profoundly ground. The percent prey attack maneuver was gleaning predominantly on ground and to a lesser extent on leaf and litter. This shows that the Grey Junglefowl is a specialist in foraging dimensions, especially on foraging strata (J'=0) and substrate (J'=0.09). High overlap was observed with the Yellow-billed Babbler (0.97) and lowest overlap with Malabar Parakeet and Purple-rumped Sunbird (0.19).

INTRODUCTION

The Grey Junglefowl, although a widely distributed species in southern India inhabiting a variety of forests, very little information was available on the ecology; only a few records of its occurrences were available (Johnsingh and Joshua, 1994). Gokula (1998) has given in short the foraging behaviour along with other species in Mudumalai. The studies by Kambarajan *et al* (2002). and Ramesh and Sathyanarayana (2002) have brought out its habitat utilization in the Theni forests. The present study examined the resource utilization of the Grey Junglefowl and its association with other sympatric species in a disturbed forest

STUDY AREA

The study was undertaken during 1999-2001 in the highly degraded and regenerating area (Scrub forest) and the mixed dry deciduous forest in Anaikatty (76° 47'E and 11° 5' N), Coimbatore at an elevation of about 560-750m above mean sea level. Anaikatty is at the foothills of the Nilgiris in the Nilgiri Biosphere Reserve, Western Ghats (Plate 1). The Western Ghats is one of the 24 Bio-diversity hot spots in the World (Mittermeir *et al.* 1998). There are 508 species of birds in it, but only a few species have been studied in detail (Ali and Ripley 1987, Gaston 1972, Johnsingh *et al.* 1987, Vijayan 1980, Khan 1980, Vijayan 1984, Islam 1994 and Gokula 1998, Vijayan and Gokula 1999).

Plate 1. Map showing the intensive study area with four transects in the Anaikatty hills (Source: Survey of India - Topo sheet 1971).

Mixed dry deciduous forest :

This forest was extracted by the forest department during the early 1980s and left for regeneration for the secondary succession. This area has many dry deciduous and some evergreen species of trees and shrubs. The dominant trees are *Acacia leucophloea, Ziziphus mauritiana, Chloroxylon swietenia, Albizia amara, Tamarindus indicus, Albizia lebbeck, Acacia polyacantha, Diospyros ferrea, Cassia fistula, Commiphora caudata* and shrubs are *Chromolaena odorata, Clausena indica, Elaeodendron glaucum, Flacourtia indica, Lantana camara, Lantana wightiana, Randia dumetorum, Premna tomentosa, Pavetta indica* and *Mundulea sericea*. Succulents such as *Opuntia dillenii* and *Euphorbia antiquorum* are also common. Since many villagers are dwelling in and around this vegetation type, anthropogenic pressures form a major threat for its existence. The tribals of the surrounding villages not only collect firewood but also trap the Grey Junglefowl and collect eggs from this forest.

Scrub forest :

This scrub forest was degraded because of extensive clearing and since 1996 SACON allowed a few acres of this land to be regenerated by planting trees and providing them protection. Studies are conducted to understand the structure of the existing plant and bird communities and also to monitor the changes in a long-term basis. Balasubramanian *et al.* (2001) have reported the vegetation of disturbed habitats at Moongilpallam area in Anaikatty.

This area consists of the regenerating trees such as *Albizia amara, Diospyros ferrea, Elaeodendron glaucum* and *Cassia fistula*. Dominant shrubs available in this area are *Mundulea sericea, Chromolaena odorata, Clausena indica, Flacourtia indica, Lantana camara, Lantana wightiana, Randia dumetorum, Premna tomentosa* and *Pavetta indica*. *Opuntia dillenii* is the common succulent and *Euphorbia antiquorum* is less common. Elephants and cattle frequently, and goats occasionally visit this area .

METHODS

Bird population was estimated for every month from the census data of three counts using variable width line transect method along four transects of 1km following Bibby *et al.* (1993). The relative abundance and density of birds were estimated. Twelve days in a month were spent to record foraging behavior of birds from the mixed dry deciduous forest. Observations were done within four hours after sunrise. This is the most active foraging time for birds (Bibby *et al.* 1993). Only one foraging observation (initial record) was taken from any individual encountered as done by MacNally (1994). Initial observation is reported to provide precise estimate of foraging location rather than that of the subsequent ones (Bell *et al.* 1986).

For each foraging attempt microhabitat details such as the height above ground, substrate, foraging method and the plant species at which the prey was found were recorded. A substrate is the place from where food is taken

by birds. Foraging methods were categorized as, glean (a stationary food item is picked up from its substrate by a standing or hopping bird), probe (as glean but, only the bird's beak penetrates or lifts the substrate to locate concealed food), pounce and sally.

STATISTICAL ANALYSIS

The SPSS statistical software (Norusis 1994) release 6.0 was used for the data analysis.

Niche breadth or Specialist-Index J' : Pianka (1921) defines ecological niche as "the sum total of the adaptations of an organismic unit or as all of the various ways in which a given organismic unit conforms to its particular environment". The resource gradient along which species showing partially non-overlapping distributions is a niche dimension (Cody 1974). The foraging specialization of each bird category for each foraging dimension (Dimension includes method, substrate, vertical layer and canopy) was analyzed using the Shannon-Weiner index H' = -åpi ln pi (Where H'= diversity and pi = the proportion of observation in subset i). These values were then converted to a standardized range using the formula J' = H'/H max (Where J' = specialization and H max = the maximum H' value obtained when the observations are distributed equally across all subsets of the foraging dimension) following Crome (1978) and Recher *et al.* (1985). J' value ranges between one and zero, with foraging specialization increasing as J' falls.

Niche overlap: The extent to which resource use overlaps between species pairs is niche overlap. The degree of species overlap in niche utilization for the different categories recorded (foraging method, substrate, canopy and foraging height) has been quantitatively expressed using Horn's (1966) equation:

$$R_0 = \frac{\sum (x_i + y_i) \log (x_i + y_i) - \sum x_i \log x_i - \sum y_i \log y_i}{(X + Y) \log (X + Y) - X \log X - Y \log Y}$$

where X and Y are the total number of observations for the two species, for the particular category and xi and yi are the number of occurrences made in the i' th subdivision within each category for X and Y, respectively.

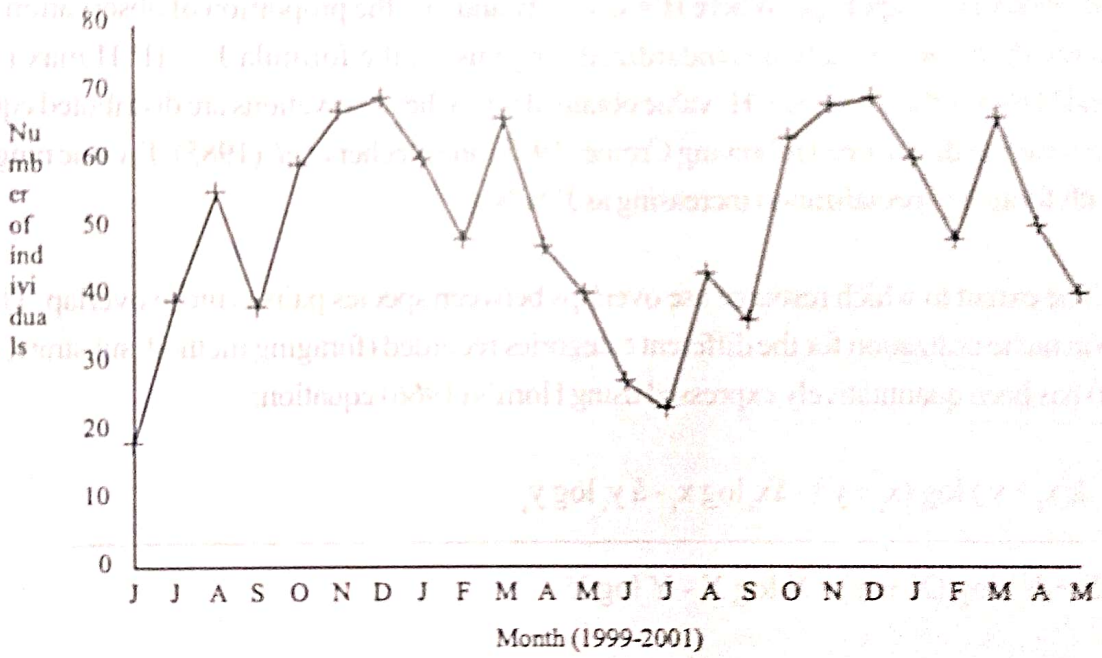
Density :
Density estimation was computed using the formula (Gates 1979)
$D = n/2LxY$
Where D = number/km^2
n = total number of individuals seen
L = length of the transect
Y = mean perpendicular distance

RESULTS AND DISCUSSION

Habitat

The Grey Junglefowl was recorded only from the mixed dry deciduous forest and not in the scrub forest at Anaikatty Hills. Gokula (1998) and Gokula and Vijayan (2000 and 2001) have recorded this species in the scrub (thorn) forest in the Mudumalai Wildlife Sanctuary. The site fidelity was due to the habitat difference as recorded by Gaston (1978 and 1983). Grey Junglefowl was not recorded in the scrub forest in this study as there was an increased area of gaps due to clearing as documented by Karr *et al.* (1982) in the moist forest near Panama and openness of vegetation as in Panama (Helle 1986). Although it is a resident species, the sightings were high during November and December (Fig. 1).

Fig. 1. Distribution of the Grey Junglefowl in the mixed dry deciduous forest



Density

Maximum density was recorded during winter followed by northeast monsoon and less density during southwest monsoon (Table 1). This seasonal fluctuation was probably because of the local movement as in other Galliformes (Sathyakumar *et al.* 1993) or high visibility and the resentment/recruitment of young at the beginning of the Northeast monsoon. Density was low during summer and Southwest monsoon, as collection of eggs (Nirmala 2002) and adults. This emission would result in lower density consistent with our observation as observed by Major *et al.* (1999).

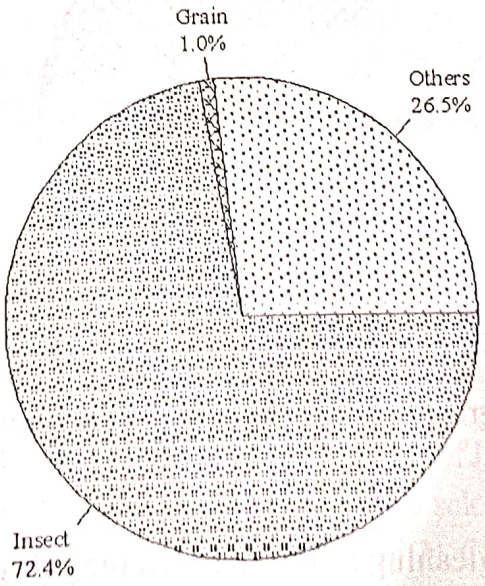
Table 1. Density of the Grey Junglefowl in the Anaikatty hills during different seasons in 1999-2001

Season	Density (Birds/ km$^{2)}$
Southwest monsoon	55.556
Northeast monsoon	120.561
Winter	149.051
Summer	95.679
Southwest monsoon	54.507
Northeast monsoon	127.525
Winter	145.503
Summer	98.765

Food

It is an omnivore feeding on insects, other invertebrates and grains with preference for insects and grains (Fig 2). Arthropod abundance undoubtedly affects the foraging behaviour of insectivorous birds (Cole, 1995). From this study it was found out that the Grey Junglefowl is an omnivore as reported by Ali and Ripley (1987) and contrary to the findings of Gokula (1998) where it is a granivore in Mudumalai.

Fig. 2. Food of the Grey Junglefowl (n=98)



Foraging behaviour

It preferred predominantly to feed on the ground (Fig. 3) as recorded by Gokula and Vijayan (2000) in Mudumalai. When the ground was further classified into litter zone, grassy ground, herbal ground and barren ground, litter ground was highly preferred (39%) followed by barren (29%), herb (20%) and grassy (11%) ground (Fig. 4).

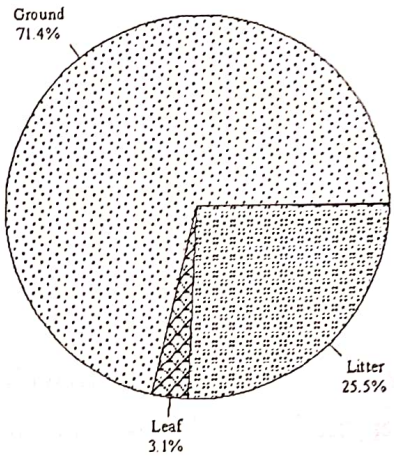


Fig. 3. Substrate used by the Grey Junglefowl in the Anaikatty Hills (n=98)

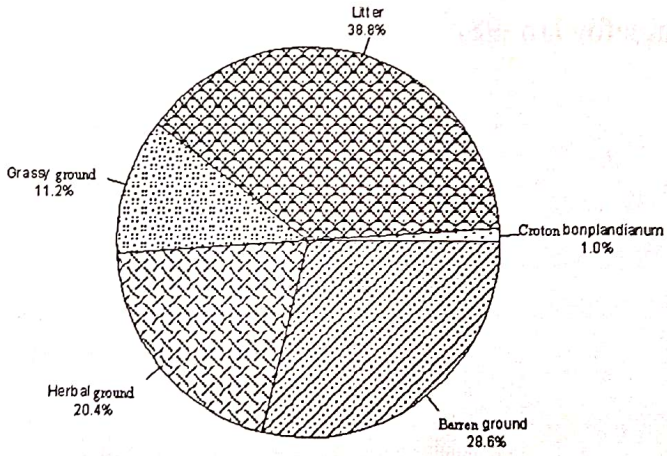


Fig. 4. Percent of plant forms and ground used for foraging by the Grey Junglefowl

Method of feeding was mainly gleaning followed by probing (Fig 5). Feeding height was restricted to 0-1m, mostly ground. The percent prey attack maneuver was gleaning predominantly on ground and to a lesser extent on leaf and litter (Fig. 4). This shows that the Grey Junglefowl is a specialist in foraging dimensions, especially on foraging strata (J'=0) and substrate (J'=0.09) as documented by okula and Vijayan (2000).

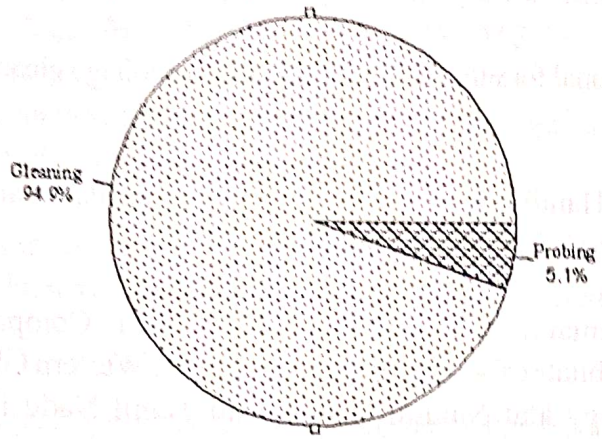


Fig. 5. Method used by the Grey Junglefowl in the Anaikatty Hills (n=98)

High overlap in all four dimensions was observed with the Yellow-billed Babbler (0.97) as both these species used gleaning on the ground whereas it had the lowest overlap with Malabar Parakeet and Purple-rumped Sunbird (0.19). It can be attributed to the availability of food resources, morphology of species and competition as suggested by Alatalo (1982), Rolando and Robotti (1985), Szekely (1985) and Gokula and Vijayan (2000). Although it competes with Yellow-billed Babbler largely, the size of the food varies with the size of the beak as observed by Johnsingh *et al.* (1987) and hence could co-occur without much competition.

CONSERVATION PROBLEMS

This species, as many other birds, is facing threat from hunting and habitat degradation and alteration. Major human disturbances in this area are from firewood collection and cattle grazing. People in the eight villages around the study area depend on the forest resources for their sustenance. Forest type (Twedt *et al.* 1999) and human disturbances are found to be affecting the breeding birds (Vijayan *et al.* 1999) especially the ground-nesting birds (Keyser *et al.* 1998). Although the Forest Department is planting saplings, habitat restoration may not be feasible unless the human pressure is reduced through eco-development programs for these villagers.

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Study on the Population of Grey Francolin *(Francolinus pondicerianus pondicerianus*(Gmelin)) from Three Habitats of Therkukaraseri, Chidambaranar District, Tamil Nadu

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ABSTRACT

Grey francolin *(Francolinus pondicerianus pondicerianus*(Gmelin)) inhabits semi arid areas interspersed with agriculture lands and human habitations. An intensive investigation on the habitat use of Grey francolin was conducted during November 1995 and October 1996 at Therkukaraseri of Chidambaranar District, Tamil Nadu. Habitats such as the open scrub with introduced flora and agricultural land are described with reference to the ecology of the species. Poaching by people has a serious negative impact on the population of Grey francolin. The importance of growing *Prosopis chilensis* which gives a natural environment for this species in the semiarid habitats, is highlighted.

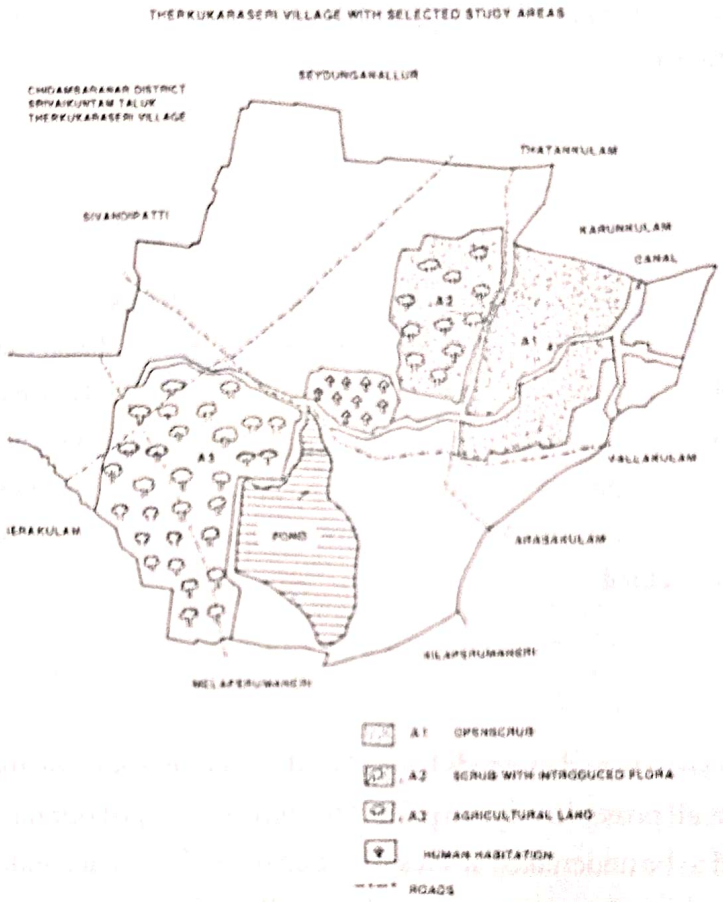
INTRODUCTION

The fast developing human society and its needs have placed a major pressure on the bio diversity. This has led to an urgent need to find out all possible ways to protect the bio diversity of our nation. Garson (1992) insisted that population studies need to be undertaken at sites where changes in habitat conditions and human impact are also measured. Only then , the information gathered may allow declines to be detected and then corrected through altered management. While the fauna of the reserve forest areas and of the national parks are well protected, the animals in the manipulation zones always face the danger of being eliminated by various factors. This problem is still severe in the case of birds with culinary value, such as *Francolinus pondicerianus pondicerianus* commonly called as the grey francolin. Population dynamics of land dwelling species with regard to present ecological situation is the basic need for any conservation measure (Johnsingh and Murali,1973; Sharma, 1978; Kalsi,1992; Ali,1996)

METHODS

Grey francolin enjoys natural distribution in the semi arid areas adjacent to human habitations. An intensive investigation based on the habitat orientation of this bird was conducted for one year during November 1995 to October 1996 at Therkukaraseri of Chidambaranar district, Tamilnadu. Based on the initial survey of the district, Therkukaraseri was selected for the intensive population studies. Grey

francolin were found to inhabit almost all areas of this village. Taking this into account, the village was subdivided into three habitats (MapI), the open scrubland representing the natural habitat of grey francolin, scrubland with introduced flora representing partially altered natural habitat and developed agricultural land representing completely altered habitat.



Dominant vegetation of open scrub land habitat A_1 is the honey mesquite, *Prosopis chilensis* , with several other herbs, shrubs, grasses and sedges . In habitat A_2, besides *P.chilensis* , several tress like *Acacia* sp, tamarind, neem and teak have been grown in between the natural habitat which remains unaltered. In habitat A3, the original scrub land has been completely changed and plantations of mango, coconut, banana, and oil palm have been established. Habitats A1, A2, A3 consisted of 48.6 ha, 32.4 ha and 81 ha respectively.

In the habitats A1, A2 and A3 the population of grey francolin was estimated by line transect method, direct count method , roost count method and dawn and dusk calling count method (Gaston,1975,1992). More than one method was followed to correlate the numbers obtained from each method. In the transect method, transects that cross though the study area were established and by walking through it 3 to 5 times a month for a period of one year, grey francolin seen were counted and recorded. Duplication would be nil as they are territorial birds restricting themselves to a particular area. In the direct count

method, 11 study plots were established in each habitat and from these vantage points, the number of birds were counted and recorded.

In the roost counting method, the roosting trees were identified in each habitat and a team of three people waited each day near the roosting area and recorded the number of birds as they arrived at the roosting site. *F.p. pondicerianus* are specific to their roosting site and do not change them. In the dawn and dusk calling count method, the vocal calls of grey francolin were counted during dawn and dusk for 3 days from November to March as it is the breeding season of these birds(Himmatsinhji,1956) The results obtained from all the above methods were statistically analyzed to test their level of significance.

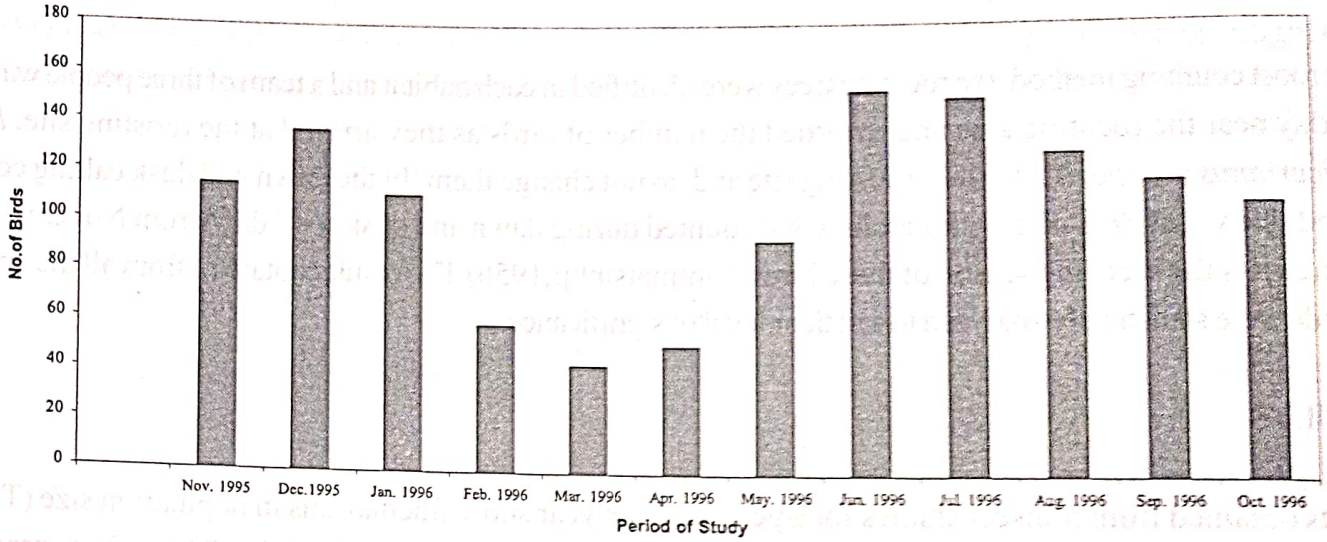
RESULTS

Results obtained from transect studies for a period of one year show fluctuations in population size (Table I,Fig.I). The population size shows a remarkable increase in June and July. There is a gradual

TABLE I Estimation of Population of *Francolinus pondicerianus pondicerianus* in three different habitats by Line Transect Method

S.No	Period	No.of Visits	Mean number of birds in habitats			Total Population in three habitats
			A1 Open Scrub	A2 Scrub with introduced flora	A3 Agricultural Land	
1	Nov. 1995	4	51	56	8	115
2	Dec.1995	4	64	59	14	137
3	Jan. 1996	4	52	47	12	111
4	Feb. 1996	5	27	25	7	59
5	Mar. 1996	4	16	19	8	43
6	Apr. 1996	3	28	18	5	51
7	May. 1996	4	43	39	11	93
8	Jun. 1996	4	62	78	13	153
9	Jul. 1996	5	66	72	12	150
10	Aug. 1996	5	59	55	14	128
11	Sep. 1996	4	57	48	12	117
12	Oct. 1996	4	47	52	9	108

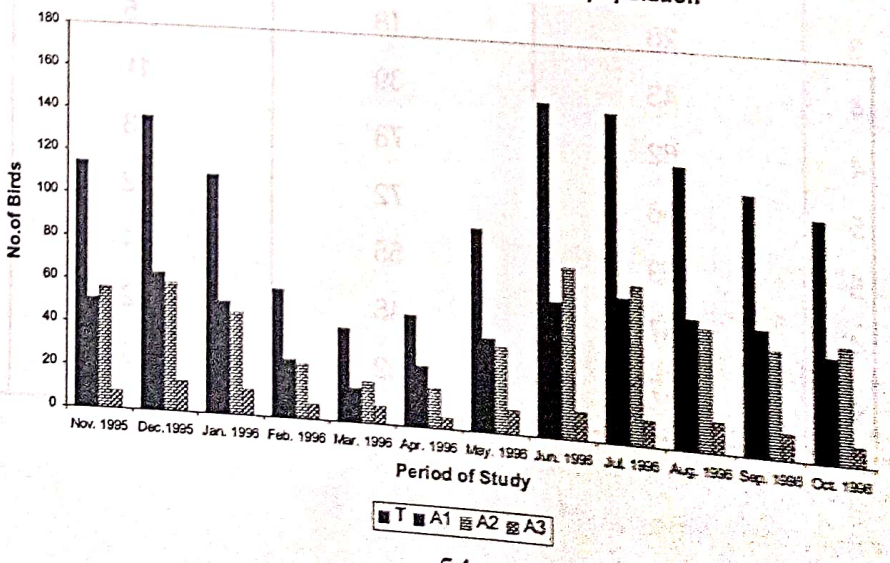
Fig.1 Population of *Francolinus pondicerianus pondicerianus* in Therkukaraseri (Line Transect Method)



decline in October and November. And the decline touches a low in February, March and April. Variation in population size may be attributed to biological factors and environmental factors. The increase in June and July may be due to the population occurring as coveys with newly hatched juveniles. The South West monsoonal regime also provides favourable food supply to the birds in these months. The slight decline in population in August to October may be due to heavy predation of juveniles. The population is very low in February, March and April as it is the breeding season with most of the birds involved in egg laying and incubation. The environment is also hot and dry with less food supply. Thus the biological and environmental factors fluctuate the population size of grey francolin in Therkukaraseri.

The population among the three habitats, A1, A2 and A3 also vary (Fig.2). While A1 and A2 showed no significant difference, the A3 population was very less when compared to A1 and A2. Direct counting

Fig. 2 Comparison of population of *Francolinus pondicerianus pondicerianus* in three habitats with total population



yielded 175 birds in A1, 210 birds in A2 and 23 birds in A3 habitat (Table II). The total population of grey

TABLE II. Number of *Francolinus pondicerianus pondicerianus* and their mean territory size in three habitats by Direct Count Method in the Months of Nov. and Dec. 1995

S.No.	Type of habitat	Area in hectares	No.of Birds				Mean No.of Birds	Population Density per hectare
			Survey1	Survey2	Survey3	Survey4		
1	Open Scrub A1	48.6	172	184	162	188	176.5	3.63
2	Scrub with introduced flora A2	32.4	224	216	206	196	210.5	6.49
3	Agricultural land A3	81	18	24	30	20	23	0.28

francolin among the 3 habitats was 410 birds. The population density was calculated to be 3.63 birds per ha in A1 , 6.49 birds per ha in A2 and 0.28 birds per ha in A3 habitat. The total population based on roost counting method was 345, dawn calling count method was 385 and dusk calling count method was 326 respectively (Table III & IV).

TABLE III. Number of *Francolinus pondicerianus pondicerianus* and their mean territory size in three habitats following Roost Counting Method in the Months of Nov. and Dec. 1995

S.No.	Type of habitat	Area in hectares	No.of Birds arriving at roosts at dusk				Mean No.of Birds arriving at roosts
			Survey1	Survey2	Survey3	Survey4	
1	Open Scrub A1	48.6	139	148	149	154	147.5
2	Scrub with introduced flora A2	32.4	182	176	179	188	181.25
3	Agricultural land A3	81	16	21	18	15	17.5

TABLE IV. Mean Number of Calls Recorded in three Habitats by Dawn and Dusk Calls Counting Method

S.No.	Month & Year of Study	Mean No.of Calls recorded					
		Open Scrub A1		Scrub with introduced flora A2		Agricultural Land A3	
		Dawn	Dusk	Dawn	Dusk	Dawn	Dusk
1	Nov. 1995	80	72	93	81	18	10
2	Dec. 1995	73	67	86	64	13	9
3	Jan. 1996	76	58	72	68	8	7
4	Feb. 1996	62	53	66	61	6	6
5	Mar. 1996	48	42	52	46	3	2

DISCUSSION

The population size varied among the three habitats. This variation is due to the active play of environmental resistance on the population. In the A1 habitat, the presence of natural flora provides adequate resting, roosting, nesting and feeding areas of grey francolin. Food availability is optimum and natural predation exists along with poaching by human beings. Disturbance is more by way of woodcutters and grazing cattle and goats. Human factors operates on population density and reduces the number of birds from a population that is otherwise successful.

In the A2 habitat, the presence of a natural habitat along with introduced flora provides additional resting, roosting, nesting and feeding areas for grey francolin. Natural predation exists, but poaching is absent. Human intrusion for cutting firewood is prohibited as it is a private land. Grazing goats and cattle cannot enter the area. Artificially devoid of all man made disturbances. All these factors suggest that A2 habitat is an ideal habitat supporting a dense population of grey francolin. However grey francolin in this habitat enjoys an artificial protection. The A3 habitat is devoid of all natural vegetation like *Prosopis chilensis*. Workers are around through out the day. Absence of natural habitat increases natural predation. Thus the population studies in the habitats suggest that A1 is a natural habitat and A2 is an ideal habitat while A3 is considered to be a zone of limitation for the distribution of grey francolin. The results also insist that natural predation has a soft effect while human poaching exerts a very dangerous negative effect.

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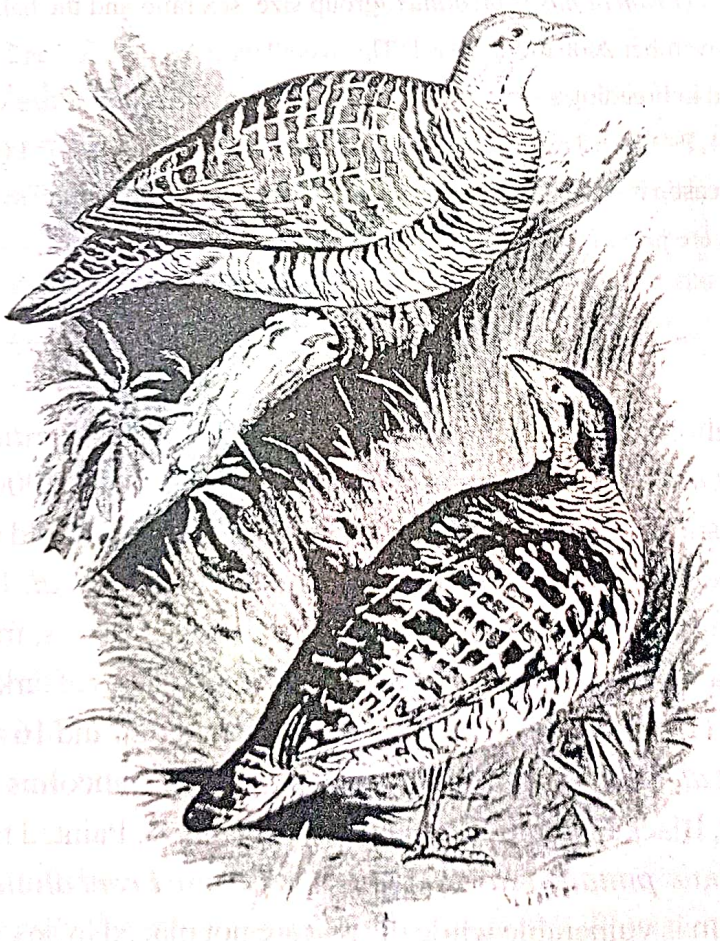

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Division of Wildlife Biology, A.V.C. College [Autonomous], Mayiladuturai 609 305.

Group size, Sex ratio and Habitat use of Black Francolin Francolinus Francolinus in Majathal Harsang Wildlife Sanctuary, Himachal Pradesh, India

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ABSTRACT

We studied Black francolin (*Francolinus francolinus*) group size, sex ratio and the habitat use in Majathal Harsang Wildlife Sanctuary from November 2000 to June 2001. The overall mean group size was 2.7 ± 0.17 (Mean ± S.E.) and in winter it was 3.7 ± 0.20 and in breeding season it was 1.38 ± 0.68 The mean group size showed significant difference across the seasons ($F=88.64$, $P<.001$). The overall sex ratio across the seasons was 1.7: 1 (male: female), in the winter it was 1.3:1 and in breeding season it was 5.4:1 The birds preferred scrub and cultivation more than expected ($P < 0.001$) while oak and grasslands were preferred less than expected.

INTRODUCTION

Francolins belong to the Suborder *Phasiani*, Family *Phasianidae*, Tribe *Perdicini* and Genus *Francolinus* (Johnsgard 1988, Crowe *et al.* 1992, McGowan *et al.* 1995, Fuller *et al.* 2000). The Family Phasianidae comprises of 38 genera, 155 species, and 399 taxa which are distributed in the old word with great diversities in SE Asia and Africa and most of them are having large ranges (del Hoyo *et al.* 1994, McGowan *et al.* 1995, Fuller *et al.* 2000). There are 106 species of the Old World partridges, quails, francolins and snowcocks, 31 species of the New World quails, six species of guineafowl, and two species of turkeys for a total of 145 species. Out of 145 species, three are critically endangered, five are endangered, and 16 are vulnerable while 121 are lower-risk species (Fuller *et al.* 2000). There are five species of the francolins found in India viz., Swamp francolin *francolinus gularis*, Black francolin *Francolinus francolinus*, Painted francolin *Francolinus pictus*, Chinese francolin *Francolinus pintadeanus* and Grey francolin *Francolinus pondicerianus*. Of these species, only Swamp francolin is vulnerable while the rest are not placed in any threat category (Fuller *et al.* 2000).

Historically, Black Francolin occurred in Southern Spain, Sicily, Sardinia, Algiers, Tunis and many Islands of the Greek archipelago. In South Asia, four sub-species are distributed from Cyprus to Burma, a range of 6,400 Km in length (Bump & Bump 1964, Johnsgard 1988, McGowan *et al.* 1995, Fuller *et al.* 2000). It was introduced in southwestern parts of United States (Hawaii and Guam) and Italy.

In India Black Francolins occurs in north upto east of Assam and south to the Deccan plateau (Ali and Ripley 1983). They are commonly distributed up to central India and out of four sub-species; three sub-species are found here (Ali & Ripley 1983). They inhabit tropical, sub-tropical and lower temperate zones (Bump & Bump 1964). The birds inhabit scrub groves, forest edges, swamps, grass plains and all kinds of crops that offer sufficient cover but are open beneath (Roberts 1991). According to Baker (1920), Black Francolin prefers tall grasslands and fairly thick scrub jungle besides arable fields and avoids open and hilly country.

We collected information on Black Francolin group size, sex ratio and their habitat use at Majathal Harsang Wildlife Sanctuary, M.P from November 2000 to June 2001.

STUDY AREA

We carried out this study at Majathal Harsang Wildlife Sanctuary (31° 15' N to 31° 18' N and 76° 56' E to 77° 02' E) in Himachal Pradesh, India between Nov 2000 to June 2001. This sanctuary (70 km^2) area lies southeast of Shimla, in district Solan. The area comes under Himalayan biographical zone 2C (Rogers & Panwar 1988). Majathal Harsang WLS borders the south bank of the river Sutlej between Bilaspur and Shimla. The altitudinal range of the WLS is between 750m to 2000m. The general topography of the study area consists of steep slopes with Chir pine *Pinus roxburghii*, Oak *Quereus leucotrichophora* and is dominated by grass and scrub slopes. Seven species of galliformes have been reported from the area (Mishra 1996).

METHODS

Vegetation in the study area was broadly categorized into six habitats according to the structure and composition. They were Pure Pine, Oak, Scrub, Degraded, Grasslands and cultivated fields.

1) Pure Pine: This habitat category consisted of pure stands of young plantations and old Chir trees *(Pinus roxburghii)*. Moderate shrub cover was formed by species like *Aechmanthera pedata, Hypercium oblongifolium, Salvia plebeja, Inula cappa* and *Berberis aristata.*

2) Oak: This habitat was dominated by of Ban Oak (*Quereus leucotrichophora)* and had other species such as *Ficus aurticulata, Ficus nerriforlia, Rhus continus, Rhus wallichii, Rhus punjabesis, Glochidion velutinum and Prunus padam*. Most of the ground was barren with little scrub cover. The major shrub species were *Aechmanthera pedata, Hypercium oblongifolium* and *Berberis aristata.*

3) Scrub: This habitat had Chir Pine *Pinus roxburghii* trees at low density. The shrubs were *Woodfordia fruticosa, Aechmanthera pedata, Hypercium oblongifolium, Berbaris aristata, Dodoenea viscosa, Rubus ellipticus and Hamyltonia svaviolens.*

4) Degraded oak forest : This habitat had few trees of *Quereus leucotrichophora* and *Sterculia villosa*, and shrub cover of *Euphorbia royalena, Aechmanthera pedata, Woodfordia fruticosa, Hamyltonia svaviolens,* and *Berberis aristata.*

5) Grasssland: There were vast areas with grass cover, and few trees of *Pinus roxburghii, Quereus leucotrichophora, and Bauhinia purpurea*. There were few shrub species present in these grasslands such as *Berbaris aristata, Indigofera hetromella, and woodfordia fruticosa.*

6) Cultivated Fields: This habitat consisted of agricultural fields near the villages and the main crops were maize, wheat and mustard.

Data was collected by walking through the selected habitat categories. We collected data in mornings as well as in evenings although we also walked these habitats during the daytime. Upon each sighting of Black Francolin, we noted details about habitat, group size, group composition and flushing distance. We measured the time effort in each habitat type and applied correction with the area of each habitat type monitored.

ANALYSES

Fluctuation in the group size and group composition were tested using both parametric and non-parametric analysis (Siegel 1956, Sokal and Rohlf 1995).

The Neu *et al.* (1974) and Byer's *et al.* (1984) technique was used to calculate the confidence intervals for analysis of availability and utilization of the different habitat types used by Black Francolin. A computer program PREFER 3 was used to calculate Bonferroni confidence intervals and significance for habitat usage.

RESULTS

Group Size

A total of 86 groups comprising 232 individuals were seen during the study period. The mean group size across both seasons (winter and spring) was 2.7 ± 0.17 (mean ± S.E.). The group size for winter months was 3.7 ± 0.20 (mean ± S.E.) while the group size in spring was 1.4 ± 0.11. The group size between the seasons differed significantly (F= 88.64,df =1, P=.001, One way ANOVA, U =179 Mann-Whitney test).

Sex Ratio

The sex ratio of the Black Francolin in the winter was 1.3:1 males per female (males =102, females =79). While the sex ratio in spring (breeding) season was 5.4:1 males per female (males=43, females=8). There was a significant differences seen in the sex ratios of the black francolins over the seasons.

Habitat use

We pooled the data across seasons to determine the habitat use by Black Francolin. The scrub and cultivated habitats were used more than expected ($P<0.05$), while grasslands and oak were used less than expected ($P<0.05$). The pine and degraded habitats were used in the in the same proportions (Table 1).

Table 1. Habitat use by Black Francolin in Majathal Wildlife Sanctuary,M.P November 2000 to January 2001

Habitat Category	Relative. Area	Expected Usage	Observed. Usage	Expected. Proportion of usage	Lower confidence limits	Upper confidence limits
Pine	0.150	10.206	8	0.150	0.011	0.212*
Oak	0.120	8.165	1	0.120	.000	0.068**
Scrub	0.270	18.371	28	0.270	0.255	0.571***
Degraded	0.027	1.837	0	0.027	0.000	0.008*
Grassland	0.378	25.719	7	0.378	0.007	0.203**
Cultivation	0.054	3.674	24	0.054	0.196	0.501***

*** used in proportion to availability; ** used less than expected; *** used more than expected**

DISCUSSION

Black francolins were found singly in the breeding seasons but in the winter months they were found in groups with two to three family groups merging together to form bigger groups as has also been reported by Ali & Ripley (1983), Biswas (1960) Diog (1880) and Johnsgard (1988). However, Baker (1920) reported that the male and female remain together through the year. In contrast, Bump and Bump (1964) and Forme (1947) reported that they are solitary. Black francolin males start calling in February to advertise their territories. Consequently there is breaking of large family groups at the onset of breeding season, which results in a change in the group size. Breeding season in these birds is very protracted extending from March to October, with some variations in the breeding season in the distribution range (Baker 1920, Ali and Ripley 1983).

Black francolin female builds nest and incubates alone while the male remains free to guard the territory (Johnsgard 1988, Roberts 1991). This results in a change in the sex ratio during breeding season. The males while advertising and defending their territory, tend to call and expose themselves, hence their sightings are more frequent. On the other hand, the sightings of the females are low as they are engaged in nest building and incubation during this period, and remain in cover.

Black francolins are found in tropical, subtropical and lower temperate zone (Bump and Bump 1964). It inhabits scrub groves, forest edges, swamps and grassy plains including crop fields which provide required cover (Ali and Ripley 1983, Roberts 1991). The Black Francolin preferred scrub and cultivated habitats as these habitats provided both cover and food.

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Parasitic Diseases of Galliformes

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ABSTRACT

Parasitic diseases have potential to control galliformes populations. Galliformes are exposed to a wide variety of pathogens and stress resulting in occurrence of infectious diseases and pathological conditions. The diseases like Marek's disease, staphylococcosis, tuberculosis, coccidiosis, trichomoniasis and heterakiasis had been reported in captive pheasants and ascariasis in free ranging peafowls. Wildlife managers, biologists and other conservationists must therefore possess adequate knowledge of the parasites, their ecology, behaviour, population dynamics as well as the diseases they cause, which enable them to control the parasites and thereby keeping a healthy stock of galliformes. Not much is known about the parasitic infections of galliformes in wild conditions though we have some information on captive pheasant diseases. Dr.Woodford, Chairman, IUCN Species Survival Commission Veterinary Specialist Group opined that disease monitoring and Veterinary management should be integral components of the Action Plan of Species Conservation Groups and Environmental Agencies.

Parasitic diseases have potential to control galliformes populations and also pose an unusual problem for conservation biologists. Galliformes are exposed to a wide variety of pathogens, leading to many infectious diseases. The causative agents are micro-parasites (such as viruses, bacteria, protozoa and fungi)or larger macro-parasites. Swarbrick (1985) reported that the pheasants suffer from a number of viral, bacterial, mycotic, parasitic diseases and pathological conditions. Diseases like Marek's disease, staphylococcosis, tuberculosis, coccidiosis, trichomoniasis and heterakiasis had been reported (Somvanshi and Singh,1998) in captive pheasants and ascariasis (Sathyanarayana and Ganesan, 2001) in free ranging peafowls.

Wildlife managers, biologists and other conservationists must therefore possess adequate knowledge of the parasites, their ecology, behaviour, population dynamics as well as of the diseases caused by them to enable them to initiate adequate control as to protect the healthy stock of galliformes. In view of the recent emphasis on policies regarding conservation of wild flora and fauna at international levels, specially endangered birds like wild pheasants and their preservation from poaching and protection from various diseases assume great importance. Dr.Woodford, Chairman, IUCN Species Survival Commission Veterinary Specialist Group opined that disease monitoring and Veterinary management should be integral components of the Action Plan of Species Conservation Groups and Environmental Agencies. Knowledge of ecology and epidemiology of parasites can thus help to solve problems in conservation biology .Disease can also pose a grave problem in captive populations which are maintained at high

density. Because captive animals are particularly susceptible to diseases, it poses a serious threat and it has become one of the principal concerns of commercial breeders.

Sonia *et al* (2001) reported that fragmentation of a continuous habitat can influence the spread of parasitic organisms in a variety of ways. They found that a majority of disease related threats to conservation arise from human-related disturbances, and it is difficult to find an example of a disease induced wildlife crisis in which human activity is not the origin of the problem. Anthropogenic effects on global and local environments (such as habitat loss and fragmentation) and predicted changes in global temperature and weather patterns may also exert a cascade of consequences on wild populations, including threats from diseases. The spread of disease into wildlife population is further facilitated by the continual contacts between livestock and wild animals.

To prevent future disease outbreaks, it is imperative to monitor the outbreaks and sources of diseases. Common sources of information that can be used to monitor parasite prevalence and intensity in animals are routine examinations of blood, tissue and faecal samples. Scans of faeces will provide information on the diversity of species of intestinal parasites in an individual, as well as on the intensity of infection. Examination of the faecal material for various parameters is thus most useful in veterinary practice.

Information on health aspects of galliformes can be useful in its management and to plan disease preventive measures. In India, at present, the information available on galliformes is spars and sketchy It is time to have an overview of the diseases of galliformes of India so as to help in undertaking appropriate preventive measures for their management in the wild.

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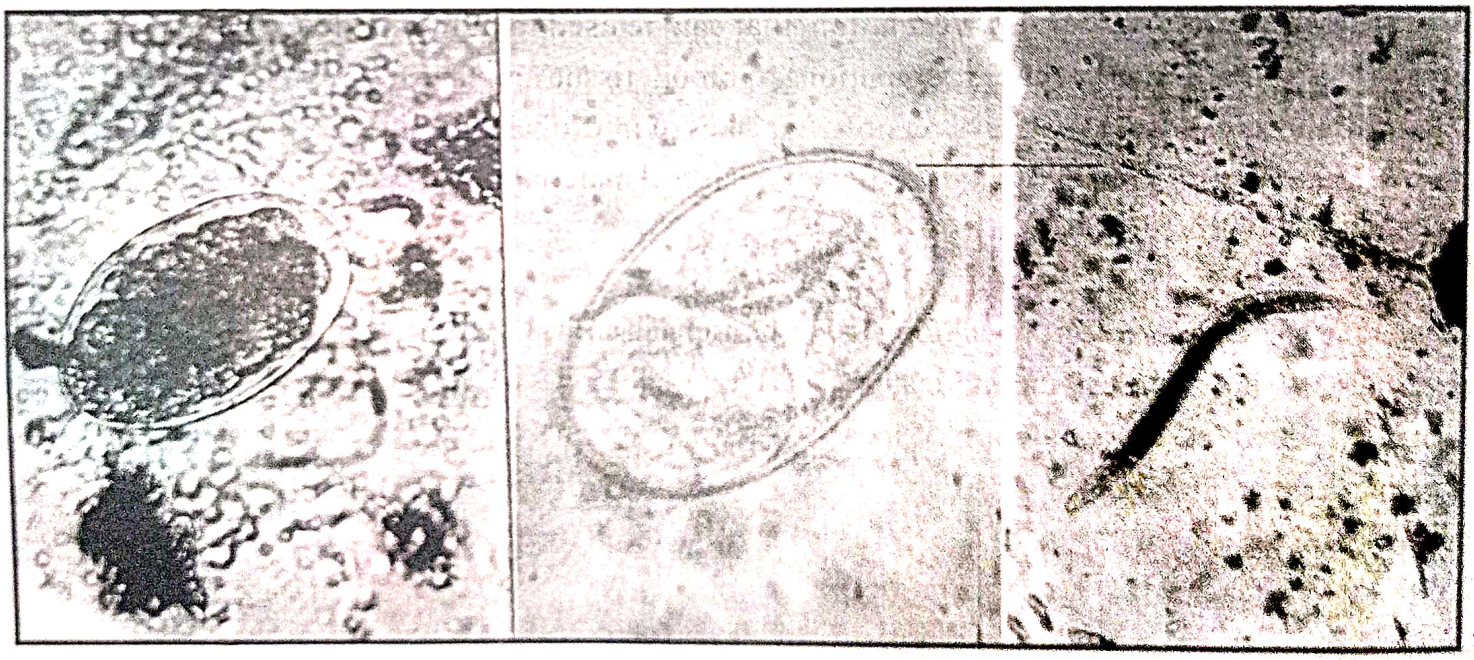

Proceedings of the National Symposium on Galliformes
Division of Wildlife Biology, A.V.C. College [Autonomous], Mayiladuturai 609 305.

Conservation Issues Relevant to Important Bird Areas Programme and Galliformes

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ABSTRACT

The BirdLife International Important Bird Areas (IBA) Programme, India, coordinated by the Bombay Natural History Society and sponsored by the Royal Society for the Protection of Birds, aims to identify document and advocate the protection of internationally important sites for the long term protection of wild bird species in India. The IBA is a site based approach and the sites are being identified using four globally uniform criteria covering a wide range of habitats and species ranging from (1) globally threatened bird species, (2)bird species with restricted ranges like Western tragopan *Tragopan melanocephalus*, (3) species largely restricted to biomes and (4) sites where birds congregate. Data has been gathered through an exhaustive literature review, workshops, consultation and surveys conducted by partners of the Indian Bird Conservation Network (IBCN). Several identified sites are important for various species of Galliformes. The process of identification of IBAs is ongoing and about 350 sites have been prioritised. Ongoing research and surveys may result in additional sites qualifying as IBAs. A majority of the IBAs identified face some form of direct or indirect threat due to anthropogenic pressures. While the protected area network forms the backbone of the programme several sites are not under official protection. In this paper, the scope of the programme, IBA criteria (for which the 49 Galliform species reported from the Indian subcontinent qualify), and the relevance of the IBA programme and issues relevant to the conservation of galliformes are discussed.

INTRODUCTION

Of the 1220 species of breeding, staging and wintering birds reported from India, 49 are Galliformes (Manakadan & Pittie, 2001). These occupy wide array of natural, semi natural and urban habitats, which have been fragmented and reduced in extent and diversity resulting in a marked reduction in abundance and range of several bird species. The BirdLife International Important Bird Areas (IBA) Programme aims to identify, document and advocate the protection and management of a network of sites that are important for the long-term viability of naturally occurring bird populations across the geographic range of those bird species for which a site-based approach is appropriate. The IBA Programme is run by the Bombay Natural History Society (BNHS), the BirdLife Partner designate in India and is coordinated through the Indian Bird Conservation Network (IBCN). A significant proportion of bird (and other animal and plant species) can be effectively conserved by the protection of key sites, either as official protected areas (national parks and reserves) with necessary and appropriate management, and or through the promotion of sustainable land-use practices (Mallari *et al.* 2001).

METHOD

IBAs' were identified using four standard global criteria, which were applied through an exhaustive literature review and a process of consultation through workshops and meetings. Where gaps in information were found surveys were commissioned to gather data.

IBA Categories and Criteria

A1. Globally threatened species:

Criterion: The site regularly holds significant numbers of a globally threatened species, or other species of global conservation concern.

This category refers to species classified as globally threatened with extinction (critical, endangered or vulnerable), conservation dependent or data deficient according to the new IUCN criteria for threatened status. Near Threatened species have not been included in this analysis. Seventy-nine Indian bird species are globally threatened with extinction. Of these 9 are listed as Critical, 10 species as Endangered, 57 are Vulnerable, 2 are Conservation Dependent and 1 is data deficient. A further 52 are classified as Near Threatened (BirdLife International 2000). Threatened Galliformes include *Ophrysia superciliosa* which is listed as Critical, *Megapodius nicobariensis*, *Francolinus gularis*, *Perdicula manipurensis*, *Arborophila mandellii*, *Tragopan melanocephalus*, *Tragopan blythii*, *Lophophorus sclateri*, *Catreus wallichii*, *Syrmaticus humiae* and *Pavo muticus* listed as Vulnerable. (BirdLife International, 2001)

A2. Restricted-range species:

Criterion: The site is known or thought to hold a significant component of a group of species whose breeding distributions define an Endemic Bird Area (EBA) or Secondary Area (SA).

Restricted range species are those that have a total world range of less than 50,000 square kilometres. An area where the range of two or more restricted range species overlap is known as an endemic bird area. Analysis by BirdLife International has shown that a very high proportion of the world's endemic birds occurs in a small proportion of the land area. The EBA's defined by these species are important hot spots for the conservation of bird diversity. Endemic Bird Areas relevant to India are 1.Western Ghats, 2. Andaman Islands, 3. Nicobar Islands, 4. Western Himalayas, 5. Eastern Himalayas, 6. Assam Plains, and 7. Southern Tibet (though the area primarily lies in Tibet, portions of it also extend into India). Areas, which only hold one restricted range species, are known as secondary areas. Secondary Areas in India are 1. Eastern Andhra Pradesh, 2. Southern Deccan plateau, 3. Indus plains, 4. Central Indian Forests, 5. North Myanmar lowlands (mainly in Myanmar but also includes lowlands of India). (Stattersfield *et al,* 1998).

TABLE 1
GALLIFORMES SPECIES REPORTED FROM INDIA AND THE IBA CRITERIA THEY QUALIFY FOR

			A1 RDB Status	A2 EBA	A3 Biome
	Megapodidae	**Megapodes**			
1	*Megapodius nicobariensis*	Nicobar Megapode	VU	AI & NI	
	Phasianidae	**Pheasants, Partridges, Quails**			
2	*Lerwa lerwa*	Snow Partridge			5
3	*Tetraogallus tibetanus*	Tibetan Snowcock			5
4	*Tetraogallus himalayensis*	Himalayan Snowcock			5
5	*Tetraophasis szechenyii*	Buff-throated Partridge			7
6	*Alectoris chukar*	Chukor Partridge			
7	*Francolinus francolinus*	Black Francolin			
8	*Francolinus pictus*	Painted Francolin			
9	*Francolinus pintadeanus*	Chinese Francolin			
10	*Francolinus pondicerianus*	Grey Francolin			
11	*Francolinus gularis*	Swamp Francolin	VU		12
12	*Perdix hodgsoniae*	Tibetan Partridge			5
13	*Coturnix coturnix*	Common Quail			
14	*Coturnix japonica*	Japanese Quail			
15	*Coturnix coromandelica*	Rain Quail			11
16	*Coturnix chinensis*	Blue-breasted Quail			
17	*Perdicula asiatica*	Jungle Bush-Quail			11
18	*Perdicula argoondah*	Rock Bush-Quail			11
19	*Perdicula erythrorhyncha*	Painted Bush-Quail			11
20	*Perdicula manipurensis*	Manipur Bush-Quail	VU	AP	
21	*Arborophila torqueola*	Common Hill-Partridge			7
22	*Arborophila rufogularis*	Rufous-throated Hill-Partridge			8
23	*Arborophila atrogularis*	White-cheeked Hill-Partridge			9
24	*Arborophila mandellii*	Red-breasted Hill-Partridge	VU	EH	
25	*Bambusicola fytchii*	Mountain Bamboo-Partridge			8
26	*Galloperdix spadicea*	Red Spurfowl			
27	*Galloperdix lunulata*	Painted Spurfowl			11
28	*Ophrysia superciliosa*	Mountain Quail	CR	WH	
29	*Ithaginis cruentus*	Blood Pheasant			7
30	*Tragopan melanocephalus*	Western Tragopan	VU	WH	
31	*Tragopan satyra*	Satyr Tragopan	VU		7
32	*Tragopan blythii*	Blyth's Tragopan	VU	EH	
33	*Tragopan temminckii*	Temminck's Tragopan	VU		7
34	*Pucrasia macrolopha*)	Koklass Pheasant			7
35	*Lophophorus impejanus*	Impeyan Monal			7
36	*Lophophorus sclateri*	Sclater's Monal	VU	EH	
37	*Gallus gallus*	Red Junglefowl			
38	*Gallus sonneratii*	Grey Junglefowl			
39	*Lophura leucomelanos*	Kaleej Pheasant			
40	*Crossoptilon harmani*	Tibetan Eared-Pheasant			
41	*Catreus wallichii*	Cheer Pheasant	VU	WH	
42	*Syrmaticus humiae*	Mrs. Hume's Pheasant	VU		8
43	*Polyplectron bicalcaratum*	Grey Peacock-Pheasant			9
44	*Pavo cristatus*	Indian Peafowl			11
45	*Pavo muticus*	Green Peafowl	VU		11
46	*Phasianus colchicus*	Common Pheasant			
	Turnicidae	**Buttonquails/Bustardquails**			
47	*Turnix sylvatica*	Small Buttonquail			
48	*Turnix tanki*	Yellow-legged Buttonquail			
49	*Turnix suscitator*	Common Buttonquail			

A3. Biome-restricted assemblage:

Criterion: The site is known or thought to hold a significant component of the group of species whose distributions are largely or wholly confined to one biome.

A biome may be defined *as a major regional ecological community characterised by distinctive animal and plant species* (Crosby, 1997). The site also has to form one of a set selected to ensure that, as far as possible, all species restricted to a biome are adequately represented. This category applies to groups of species with largely shared distributions that occur mostly or wholly within all a part of a particular biome and are, therefore, of global importance. A site selected for these criteria has to form one of a set of sites selected to ensure that as far as possible all species and habitats characteristic of a biome are adequately represented. The major biomes in India as classified by BirdLife international are - biome 05: Eurasian high montane (alpine and Tibetan), biome 07: Sino-Himalayan temperate forest, biome 08: Sino-Himalayan subtropical forest, biome 09: Indochinese tropical moist forests, biome 10: Indian peninsula tropical moist forest, biome 11: Indo-Malayan tropical dry zone, biome 12:Indo-Gangetic plains and biome 13: Saharo-Sindian desert.

A4. Congregations:

Criteria: A site may qualify on any one of the four criteria: i) Site known or thought to hold, on a regular basis, >= 1% of a biogeographic population of a congregatory waterbird species, ii) Site known or thought to hold, on a regular basis, >=1% of the global population of a congregatory seabird or terrestrial species, iii) Site known or thought to hold, on a regular basis, >= 20,000 water birds or >= 10,000 pairs of seabirds of one or more species and iv) Site known or thought to exceed thresholds set for migratory species at bottleneck sites. (This criterion is not relevant to Galliforme species.)

RESULTS

IBAs are the first comprehensive study in which sites have been identified for bird conservation. 350 IBAs have been identified so far. This list however is dynamic and not a fixed list of sites. Ongoing research and surveys may result in additional sites qualifying as IBAs. Around 90% of IBAs in India are important for one or more of the 79 globally threatened species in India and 47% for the 74 restricted range species found in India. Almost all IBAs fall under at least one biome and hold some of the 374 bird species that fall in the biome criterion.IBAs have also been identified for species that congregate in large numbers such as congregator Terrestrial Birds, wintering and passage waterbirds and breeding seabirds. About 17% of the IBAs identified beling to this category. Though the protected areas network forms the backbone of the IBA process about 45% of the IBAs are not under any formal protection. Even IBAs that come under the protected areas network face immense pressure from communities living in and around them. Almost 99% of the IBAs identified face some form of direct and indirect threat from anthropogenic pressures.

DISCUSSION

Identification of the network of sites through the rigorous application of standard and quantitative ornithological criteria assures their international importance. The global standar dization of the criteria facilitates comparisons between sites at local, national, regional and global levels. These criteria are compatible with those used to designate wetlands of international importance under the Ramsar Convention and Special Protection areas under the EC Birds Directive (Heath and Evans 2000). The IBA criteria are simple and robust enough to be applied uniformly and cost effectively (Barnes 1998). The criteria ensure that the sites selected as IBAs have true significance for the international conservation of bird populations, and provide a common currency that all IBAs adhere to. This creates consistency and enables comparability between sites at national, continental and global levels.

These sites are identified on the basis of bird numbers and species complements that they hold, and are selected such that taken together they form a network throughout the species biogeographic distributions. This network may be considered, as a minimum essential to ensure the survival of these species across their ranges, should there occur a net loss of remaining habitat elsewhere through human or other modification. Therefore, the consequences of the loss of any one of these sites may be disproportionately large. The continued ecological integrity of these sites will be decisive in maintaining and conserving birds for which a site based approach is appropriate. Legal protection, management and monitoring of these crucial sites will be important targets for action and, many but not all bird species may be effectively conserved by these means. (Heath and Evans 2000).

Limitations of the IBA approach

- The IBA approach only works for those species for which a site-based approach is appropriate. Bird species, which are highly dispersed or nomadic are not well protected by the IBA approach (such as large raptors, cranes and bustards, which are dispersed at low densities across wide areas and are nomadic species).
- For other species, the IBAs might be only appropriate across some of their ranges or for parts of their life cycles, (e.g. colonial nesting species that disperse extensively during the non-breeding season) (Barnes,1998).
- Any strategy for the long-term protection of biotic diversity should encompass evolutionary and biogeographic considerations. The IBA programme attempts to take this into account by selecting a network of sites that were spread across most habitats and in different areas of the species distributions. However sub-specific variation was not taken into account. Any future assessment should attempt to include sites where different morphs and subspecies (particularly endemic and restricted range subspecies) are located (Barnes, 1998).

- The IBA programme is just one approach to bird conservation. The IBA criteria are fairly stringent and many sites that are of undoubted local, provincial and national importance fail to qualify as IBAs. This does not mean that they are not important for conservation; on the contrary these sites often fulfill vital conservation roles at local scales. It must be emphasised that sites not designated as IBAs are not dispensable and their role in a wider land-use conservation strategy may be as vitally important as that of any IBA (Barnes 1998).

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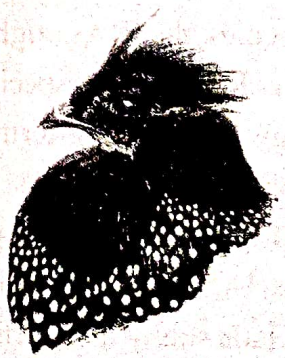

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Turkey Farming Under Semi-Intensive System of Rearing in Thanjavur District

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ABSTRACT

In Thanjavur District of Tamil Nadu, which is predominantly agriculture oriented, turkeys are generally reared under semi-intensive system of management. The types are mixed varieties of birds with full white and black and white admixture. Minimal housing facilities are provided with thatched roof and litter. Floor space ranges from 2 to 5 square feet per bird, depending on the age of the birds. Perches are provided to help birds relax. Natural breeding is generally successful under good management. Hens start laying eggs when they are about 30 weeks of age. The maximum yield is about 100 eggs per year. Males are ready for breeding around 35 – 40 weeks of age. Incubation period is 28 days. Small-scale electrical incubators are used for hatching. However, foster incubation with country fowls is a common practice. Day-old turkey poults weigh around 40 – 60 grams, depending on the variety. Artificial brooding is done with electric bulbs as a source of warmth for a period of 15 days. The turkey poults are started off with broken rice or Bengal gram with the boiled / fried and minced chicken- egg as a standard source. Broiler starter feed is offered with additional protein source such as groundnut oil cake and salt free fish meal. Medication is done minimally with vitamin preparations. Vaccinations are given to protect against New Castle and pox diseases. Though there is no specific marketing age, at about 6-7 months of age, turkeys attain 4 to 6 kilograms, for females and males toms respectively under semi intensive system of rearing.

INTRODUCTION

Two taxonomic families of birds have been domesticated with ease. Phasianidae are pheasant-type game birds that include chickens, turkeys, quail and guinea fowl, and the Anatidae family comprising of waterfowl that include ducks and geese. Turkeys are native to the new world. Domestic turkey *(Meleagris gallopavo)* is believed to have been domesticated in Mexico in 2500 B.C. Reported to have been sighted by the settlers in the early sixteenth century in the North America; by early 17th century they had crossed two subspecies and got the popular American Bronze which was used well into 20th centuries, until the selection for broad-breasted turkey birds was taken up in 1920s. In 1950s the USA government developed the small broiler turkey the Beltsville Small white. During the period from the 16th to 20th century turkeys spread through out the world as domestic birds (Rose,1997). In India, turkey farming has been very scattered and virtually a backyard venture. But there are indications that there is a steady growth of turkey farming in the country and efforts are on to make the turkey a popular variety. The small and marginal farmers of the Cauvery delta regions are taking up to turkey farming (Majumdar *et al.*, 1999; Sheriff, pers.comm).

STUDY AREA

The study area included Thanjavur, Thiruvaiyaru, Orathanadu, Pattukkottai, Kumbakonam, Papanasam and Budalur taluks of Thanjavur district of Tamil Nadu. The turkey-population size varies from 10 to 100 birds and the average is about 20 birds. The farmers of Thanjavur district are rearing turkeys mostly under semi intensive system, with minimal investment for housing, equipment, feed and management.

METHODS

The study recorded various aspects of turkey farming with respect to housing, feeding, brooding, litter material used, breeding, disease control and other management practices along with the economics of rearing turkeys under semi intensive system of rearing in Thanjavur district.

RESULTS

Housing for turkey is generally a make shift arrangement with thatched roof and mud floor. Majority of the farmers use home made wooden boxes and fishing nets. Disease control and prevention is found to be crucial in order to maintain a healthy, productive flock.

The litter materials used are generally paddy husk or groundnut shell. The litter is spread at 5 cm thickness and covered with a paper preferably rough or corrugated one to avoid eating of litter and slipping of the young turkey poults The floor space provided is one square foot / bird for the first 3-4 weeks, 1.5 sq. ft./ bird up to 8 weeks; 2 sq. ft./ bird up to 12 weeks and 2.5 sq. ft / bird up to 16 weeks and 3 to 5 sq. ft./ turkey, there after.

The basic husbandry activities such as sanitation measures with fresh air, clean wholesome water, balanced nutrition, good litter and warmth especially for the first four weeks are provided. The source of heat in the brooder is generally electrical heat and the area for brooding is an enclosure arranged with the sides of the brooder guards measuring 30 cm in height in a circle so that the corners of the brooder guards are round. The starting temperature is 95° F in the first week then gradually reduced by 5° F every week until it is 70° F - 75° F. After brooding period is over, the birds are taken away from the heat source and turned to a wider area with good ventilation and away from predators.

For adult birds under intensive system of rearing, females require 150 g /day / bird and males require 200 g /day/bird of concentrate feed. The requirement of feed per bird up to 8 weeks is about 5 kg; from 9 weeks to 24 weeks, about 14 –15 kg of concentrate feed is required. It is found to be better to feed the birds with some green grass and leaves of desmanthus, stylo, subabul and hariali and indigenous grass and other weeds at 100 g / bird / day to reduce the cost of feeding and help turkeys get some natural substances. The mineral mixture requirement is at two per cent level. Broiler starter feed is offered with

additional protein source such as groundnut oil cake and salt free fishmeal at the level of 1 kg each per 10 kg of broiler starter feed.

Turkeys attain sexual maturity at about 30- 35 weeks. Clutch size is about 11 eggs; eggs weigh around 65 g. The weight of the egg varies with the age of the bird. Turkeys lay their eggs in the late morning to early afternoon. Incubation time is 28 days, hatchability is found to be about 90 %. Incubation is done in small-scale electrical incubators. However, foster incubation with country fowls is a common practice. Day-old turkey poults weigh around 40 – 60 grams, depending on the variety. Though there is no specific marketing age, at about 6-7 months of age, in the semi intensive system of rearing, turkeys attain about 4 and 6 kilograms, for turkey females and toms respectively. The productive life span is five years and turkeys are known to live for a total life span of around 10 years (Rose, 1997; Majumdar, 1999; Sheriff, pers.comm).

The farmers follow basic bio-security measures. Medication is done minimally with vitamin preparations. Vaccinations are given to protect against New Castle (RDVF on day 7 and RDVK at eight weeks) and and pox diseases (pox vaccine at 3 to 5 weeks of age) which are common. *Esch coli* infection is also a problem.

DISCUSSION

The farmers of Thanjavur district in Tamil Nadu are rearing turkeys under semi intensive system. Turkey poults from day one require special care in feeding, as they are slow starters. Boiled or fried egg white of chicken along with the Bengal gram mash, is used as a starter diet for young ones. This is done for at least four weeks. Since the first few weeks are very crucial the poults are hand fed to avoid mortality due to starvation (Wylie *et al*, 2001). Chick mortality is generally a major problem in turkey farming and is attributed to starvation. Enough care is to be taken to avoid choking. Once the birds are of 6 weeks of age, they are turned out for foraging. Though hatching percentage is claimed to be about 90%, some farmers have difficulty in achieving optimal hatching due to problems in breeding practices. Heavier males, improper grooming of toenails causing injuries to females are some of the problems encountered. (Majumdar *et al.*, 1999; Sheriff, 2001). Although it is well documented that turkeys roost in the wild, under commercial farming situations no means is provided to this behaviour. Adding perches to the environment could be beneficial in giving birds the opportunity to perform a natural behaviour, and to decrease crowding at floor level, which has been shown to disturb the sleeping cycle (Martrenchar *et al*, 2001).The cost of production works out to about Rs.60 / kilo gram of live weight under semi intensive system of rearing and the farmer fetches about Rs.20 to 40 a kilo depending upon the season in about 8 months of age. The most suitable and remunerative venture seems to be semi intensive system of rearing with enough foraging area having good mixed vegetation for the turkeys to graze

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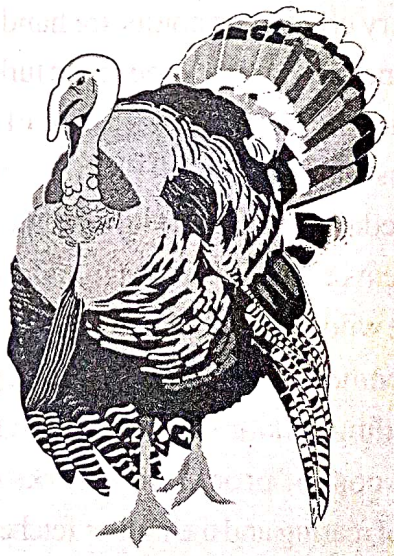

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Call to Save Our National Bird, Indian Peafowl (*Pavo cristatus*)

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ABSTRACT

The Indian peafowl (*Pavo cristatus*) population is dwindling due to food poisoning by farmers in some parts of India to save their crops, illegal removal of eggs and poaching for meat and feathers. Consumption of eggs by the local people for supposedly high medicinal value is one major threat, though there is no scientific basis for such claims on its medicinal properties. In order to avoid the illegal killing of peafowl, awareness must be created among the public about the values and importance of this bird in the ecosystem. Strict action against poachers and understanding detailed scientific research are required for conservation of this species.

Our National Bird, the Indian Blue peafowl, *Pavo cristatus* finds an important place in Hindu Mythology. It is one of the most attractive birds with a train of brilliantly bluish-greenish coloured feathers. In recent years these birds are facing number of problems such as poaching, egg predation, habitat degradation and food poisoning. These problems have led in the decline of peafowl populations. Although peafowls are included under scheduled I in Wildlife (Protection) Act, 1972, poaching and poisoning of peafowls still continue because of enforcement problems.

Information with regards to food poisoning of peafowls as appeared in the News papers, are as below: For generations , the peafowls were scared by employing trained dogs and by shouting to drive the peafowls in order to protect the crops. In some places crackers were also used to scare the peacocks. Now this trend has been changed. In Bhopal, the bajra seeds are coated with toxic substances such as organophosphates which resulted in the death of 70 peacocks (The Hindu, July 13, 2000). It is reported that such mass scale deaths generally occur during the onset of sowing or harvesting season. Fifty peacocks, in Maharajapura village, alleged died after consuming of bajra contaminated with chemicals. Peacocks died due to haemorrhage of the stomach caused by chemicals belonging to the mercuric and carbomate group.

In Morena (Madhya Pradesh) 29 and 80 peafowls on 8th July and 14th August 2000 died after consuming chemically treated bajra seeds (The Hindu, July 8, 2000; August 14, 2000). It is a sickening (The Hindu, July 13, 2000) to know that six peacocks died after consuming chemically treated soyabeen in Jahabhla district, Madhya Pradesh. It may be mentioned that some Narikuravas belonging to tribal community had been hunting peacocks for their medicinal purposes in Tamil Nadu (The Hindu, January 20, 2000). In Palankottai village, Tirunelveli district, Tamil Nadu, 37 peacocks were found dead (The Hindu, November 17, 2000) in a single day due to food poisoning. The culprits had strewn poisoned food in the field to kill the

peacocks which were destroying the crops. Consumption of eggs by the local people for their supposedly high medicinal value is another major threat. However, there is no scientific basis for such claims on its medicinal properties. It is sad to know from the Animal Welfare Board of India News letter (2001) that the peacock fat in 30 bottles which were meant to be exported to Malaysia were seized from the KBT Export company, Chennai by the Deputy Director of Wildlife Preservation, Southern Region, Chennai.

In spite of legal protection given to peacocks, the problems continue and unless the amended wildlife laws are strictly enforced, this trend will continue. The problem of effective law enforcement seems to be the best through local education initiatives, anti-hunting patrols and other messages in order to safeguard the peafowls. We have to urge the Government to take steps to protect the crops raised by farmers in the field by other means. Awareness must be created among the public about the values and importance of this bird in the ecosystem. Scientific research is required for the conservation of this species. Reflective ribbons which are more effective and easily adaptable by the farmers in the field for scaring the birds should be encouraged.

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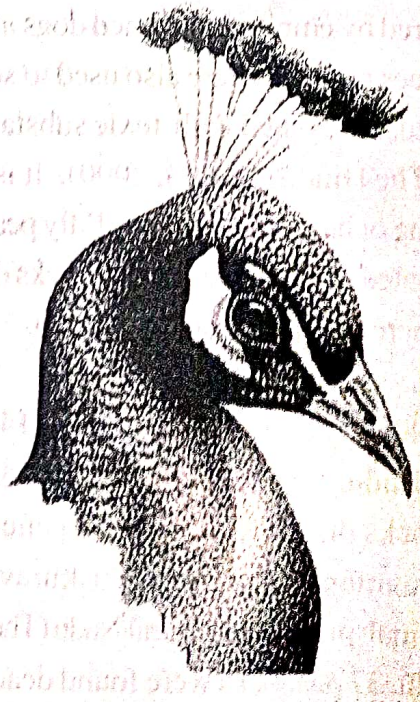

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Environmental Education and Galliformes Conservation

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ABSTRACT

Wildlife Biologists and Managers of Protected Areas are much concerned about galliformes and their habitat. As part of conservation strategies, the Pheasant Specialist Group(IUCN) has taken initiatives to promote awareness among people at every level and it has emphasized the need to begin such initiatives at the local level. Special programmes focusing on target groups at local scale have to be designed in such a way that programme provides a persuasive effect. Such programme enable the people to realize the negative consequence of species loss and provide options for involvement in galliformes conservation. Considering the human population size, the awareness programme require simultaneous approaches; visual media, nature camps, training workshops, mobilizing support for the conservation activities from policy makers and politicians. Establishment of Eco-clubs and Nature Clubs would form effective platform to carry out the above activities that will translate into long-term survival of the Galliformes.

Wildlife Biologists and Managers of Protected Areas are much concerned about galliformes and their habitat. Environmental education is planned and designed to create an awareness of the public regarding threatened environment. Many environmental problems, at the global, national and local levels, were escalating at a most rapid rate during the last few decades. Awareness and the need for conservation focus on the root causes of environmental degradation. Thus, environmental education has become a priority area concerned about the environment and its associated problems, and to provide knowledge, skills, attitudes, motivation and commitment to work individually and collectively, on various issues. As a result of a global concern about the deterioration of the environmental, renewed interest on local environmental concerns and an awareness for conservation has developed during this decade. We know that a education leads to empowerment and awareness leads to conscience building.

The National Policy on Education, 1986 has rightly emphasized a need for equipping children with more knowledge, attitude, values and skills to face and to adjust to changing social conditions. The environmental challenges and problems should be taught by appropriate methods. Environmental education is a new kind of integrative teaching characterized by encouraging inclusive thinking by a continuous training of habits in small steps and by the development of general attitude of openness to new aspects. The United Nations Conference on Human Environment held in Stockholm in June 1972 stressed that development of environmental education is one of the most powerful instruments to solve the environmental problems. In order to conserve gallilformes, the Pheasant Specialist Group(IUCN) has taken steps to promote awareness among people at every level and it has emphasized the need to begin such initiative also at the

local level. Special programmes focusing on target groups at local scale have to be designed in such a way so that such programmes provided a persuasive effect, enabling people to realize the negative consequence of species loss and providing an option for involvement in galliformes conservation.

An education campaign is very much needed for conservation of galliformes. In order to avoid illicit poaching of galliformes, awareness must be created among public about the value and importance of these birds in the ecosystem. The emphasis must be to encourage villagers to take action based on their own concerns. It is suggested that a specific education programme should be started to train environmental managers and the local population must be encouraged to depend less on the forest and wildlife in general.

Specific programmes are essential to create an awareness among the need and importance to protect these birds and their environment. To make the galliformes conservation programmes fruitful, the first task is to approach the tribles. The future of galliformes and their environment depends on the social and economic concerns of local people.

The Target groups are School children, visitors to National parks and Sanctuaries, and the rural poor living in areas where there is severe shortage of natural resources. Environmentally sound programmes and technologies have to be tried out and people made aware of them. To create galliformes conservation consciousness among youth and students Eco-clubs and Nature clubs should be specially involved. Lectures are to be conducted and pamphlets and posters must be displayed in areas where the galliformes are commonly found.

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1. Status and Distribution of Pheasants in India

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Of the 17 species of pheasants found in India, six are globally threatened as per IUCN threat categories of 1994(a). Global threat assessments do not necessarily reflect the true status of these birds on a national level and as a result several species of pheasants found in India have been accorded a lower threat category than warranted. A review of threat categories at a national level is suggested. An analysis of pheasant distribution in India based on their richness within a 1° x 1° grid square identified three areas of exceptional pheasant richness (8 or more species) and 11 areas of high pheasant richness (6-7 species). The paper presents information about important locations for each species with suggestions for their conservation.

2. Is the Current Status of Pheasants in Great Himalayan National Park (Himachal Pradesh) an Eye Opener? - A Reality Check

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The Great Himalayan National Park (GHNP) is amongst the few areas in the world, known to support a substantial population of Western tragopan, along with four other Himalayan pheasants. Conservation attempts in GHNP have shown significant linkages with these pheasants, consistently projecting the Western tragopan as a 'flagship' species. As part of a multidisciplinary research project undertaken between 1995 and 1999, we assessed the conservation status of the pheasants in this area. A habitat model was developed in Geographical Information System using remotely sensed data of IRS LISS-II combined with Digital Elevation Model. The results revealed strikingly low availability of potential habitats for these pheasants. Within the entire area of GHNP (754.4 km^2), a maximum of 36.6 km^2 (4.9%) is only available to Western tragopan. Similarly, the maximum areas potentially available for Himalayan Monal, Koklass, Cheer and Kalij pheasants were estimated to be 92.5km^2 (12.3%), 41.9km^2 (5.6%), 1.0km^2 (0.13%) and 1.2km^2 (0.16%) respectively. Though the surrounding areas in Tirthan, Sainj Wildlife Sanctuaries and eco-development zone have considerable area as potential habitats, majority of which is unlikely to sustain pheasant populations. Resentment of people due to restriction on resource use following final notification of the Park and upcoming Parvati Hydroelectric Project in this area appear to have challenged the survival of the pheasants. Given such inevitable or inappropriate situations, species-specific approach has been suggested as an alternative or immediate option to ensure pheasant conservation. The current scenario, both in terms

of available habitats and recent developments, has certainly provided a 'warning-signal' and the urgency to look beyond GHNP, at landscape level for long-term conservation of the pheasant species.

3. Distribution and Current Status of Western Tragopan (*Tragopan melanocephalus*) in Himachal Pradesh, India

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Western tragopan (*Tragopan melanocephalus*) is a restricted range species, confined to the north-west Himalaya. It is one among the most threatened Himalayan avifauna and is considered vulnerable to extinction. Fundamental information on the distribution and population status of the species in its distribution range is scanty. As an attempt to bridge the gap, extensive surveys were carried out between November 1998 and June 1999 to document the distribution and status of this species in Himachal Pradesh. The methods adopted include trail walks and call counts. Of the total of 14 sites surveyed in the districts of Chamba, Kullu and Shimla in Himachal Pradesh, we ascertained its presence in seven sites and additionally, confirmed reports from five sites. The highest encounter rate was obtained at Bangori (0.36 birds/km) in Chamba district. During the spring call counts conducted in Chamba at 13 locations in four sites, a total of 43 calling birds were counted. The mean density index was estimated to be 8.55 ± 1.08. Specka, an adjoining forests in Chamba district, have Western tragopan populations that are comparable to the best areas and hence, need immediate protection.

4. Status, Distribution and Conservation of Galliformes in Chail Wildlife Sanctuary, Himachal Pradesh

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The Chail Wildlife Sanctuary in Himachal Pradesh a major tourist attraction and is well known for supporting high abundance of Cheer pheasant (*Catreus wallichi*). The sanctuary is interspersed with more than 120 villages and is under high biotic pressure. Bouldary spaces and oak trees in the steep gullies of grassland were observed to be suitable roosting sites for pheasants. All seven species of Galliformes are resident in this region, but few were locally isolated and confined to specific areas. Peafowl (*Pavo cristatus*) and Red junglefowl (*Gallus gallus*) were recorded only in lower part of the sanctuary along the Ashani and Giri River. Kalij (*Lophura leucomelanos*) were sighted between 1,500-2,200 m in the oak forest. On a few occasions, Kalij were seen with Cheer, but Cheer usually avoided dense oak forest and confined to the grassland. Koklass

(*Pucrasia macrolopha*) were less abundant among all pheasants, one pair each was seen in Blossom and Khari-un forest and showed preference to oak forest. Although Cheer is an endangered species, but widely distributed in Blossom as well as in Khari-un, one more grassland site of cheer was found near to Bhagairh village. Chukor partridge were isolated and less abundant, and encountered only in scrub forest of Blossom. Kalij were widely distributed and most abundant among all pheasant. Black francolin (*Francolinus francolinus*) were sighted and heard commonly near crop fields and human settlement. Although the Sanctuary area is not very large (10,500 ha), the observed richness and abundance of pheasant was very high. Presently all pheasant species are facing serious threats and need reduction in biotic pressure for their survival.

5. Distribution of Pheasants in Chamba District, Himachal Pradesh

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Seven species of pheasants are distributed in Chamba District (Himachal Pradesh). There is little information on the distribution and status of these species. We conducted surveys in chamba from 1994 to 1999. The main aim was to produce inventories of pheasant species in the District and produce details about their habitats. We surveyed 15 locations (32°33' - 33°13' N & 75°49' - 77°03'E) within the altitudinal range of 1800m to 4500m. The major habitat types surveyed were sub-tropical, dry-temperate, wet-temperate, sub-alpine and alpine. We used trail monitoring and call counts to generate encounter rates and density indices of these species. Himalayan Monal was present in all areas, Western Tragopan was present in all non-sanctuary areas and Cheer was found in nine areas. Highest encounter rates for Monal obtained in Sara, Bhataal and Kugti and varied over years ($F = 3.68$, $P<0.05$, One Way - ANOVA). Encounter rates for Cheer were highest in Tundah and Bhataal and no significant variation was observed over years. Encounter rates for Western Tragopan were highest in Sara, Tali and Bhataal did not vary across years. Keeping in view the concentration of pheasants found in these areas, we recommend that areas be afforded protection for the conservation of the pheasant species and their habitats.

6. Field Techniques to Capture and Radio-track Western Tragopan: A Case Study from the Great Himalayan National Park, Himachal Pradesh

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Attempts were made to radio-tag Western tragopan (*Tragopan melanocephalus*) to study the habitat use and movement pattern in the Great Himalayan National Park, Himachal Pradesh. Fall

nets (n=6) with trigger based system and 'leg-hold noose' (n=9) were placed in predetermined localities (n=12) such as closed forests (n = 6), *thaches* (n=2) and *nullah* (n=4) for trapping the birds. Despite the intensive efforts of 256 man-days and 6694 trap hours in April-June 1999, the trap success was very low with just one female bird. Nonetheless, the traps were found to be effective and there were incidental trapping of 12 other bird species including Hill partridge (4), Koklass pheasant (1) and Eurasian woodcock (4), majority of which got trapped in 'fall nets' (70%). The Western tragopan, trapped in 'leg-hold noose', was radio-tagged with necklace type collar. Triangulation method was preferred over home-in to record radio-locations, and the sampling was done at three time scale (6 - 10 hrs, 11 - 15 hrs and 15 - 18 hrs) on every third day until November 1999. A total of 72 radio-locations represented by 52 in summer and 21 in autumn seasons were obtained, plotted on 1:50,000 topographic map and the home range was estimated based on 100% Minimum Convex Polygon in Arc/view software. Though conclusive inference could not be drawn based on just one individual, the findings on home range and macro-habitat use seem to largely concur with the earlier studies on the species and its congeners. Moreover, the study also provided a positive indication suggesting that with slight changes in trapping approach, the trapping success could be increased, and there by will increase the sample size of radio tagged birds. Inference based on adequate number of birds would be persuasive and would significantly contribute to conservation of this species.

7. Studying Habitat Utilization by Pheasants in India : A review

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Quantifying habitat use by pheasants is often difficult due to problems associated with sampling these shy and elusive birds in dense cover and difficult terrain. Distribution pattern of pheasants, their specific habitat preferences, particularly micro-habitat features, and the inherent variation in ranging and movement patterns in different seasons are some of the major factors that cause difficulties in sampling and data collection Scientific studies on pheasants in India began in early 1980s in the form of status surveys and short studies, and were followed by intensive ecological studies using simple techniques and analyses until late 1980s. During the 1990s, studies on the ecology of pheasants made rapid advances study design, use of modern techniques and analyses. Early studies on pheasants were initially dealt at the macro (habitat or vegetation type) and micro-levels by using analysis such as indices and testing for disproportionate use that included Chi-square test and/or availability-utilization analysis as proposed by Neu *et al.* (1974) and Marcum & Loftsgarden (1980). However, it was realized that availability-utilization analysis had drawbacks due to errors in defining study area limits and subsequently the proportions of resource type assumed to be "available" for a species by the researcher were

not true. Moreover, there were problems with statistical assumptions involved in field data collection versus data analysis. Further, the role of micro-habitat and environmental variables in the specific use of habitats by pheasants was realized. This led to the understanding that use of habitat factors and vegetation types cannot be considered in isolation and that there are additional problems due to auto-correlations amongst various factors at the macro and micro levels. In the recent past, studying habitat use by pheasants included use of appropriate methodology and analytical procedures, particularly use of univariate and multivariate statistics and use of radio-telemetry as a tool. We present examples from recent studies where analysis have been carried out by using Factor Analysis, PCA, Discriminant Analysis and Compositional and Indices Analysis have been used by the researchers to explain habitat choice by pheasants. Another significant advancement is the awareness amongst researchers for possible errors and precautions in such analysis and interpretation of results.

8. Habitat Ecology of Cheer Pheasant in Garhwal Himalaya

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An intensive study on the habitat ecology of Cheer pheasant (*Catreus wallichii*) in the district Chamoli and Pauri Garhwal, Uttaranchal (29° 36'N-31° 5'N & 78° to 80° E) was initiated in October 2000. Preliminary results indicate that the Cheer pheasant is very selective to Chir-pine and Pine mixed Oak forests (*Pinus roxburghii*, *Quercus* sp, *Rhododendron* etc.). Most of the Cheer sightings were recorded between 1,000 to 2,150 m altitude on the hill slopes having about 40% rocky cliffs, 40-75 slope angle, 70% forest canopy cover and 80% grass cover. Study is in progress to detect the response of the species to seasons and anthropogenic factors.

9. Habitat Preference of Grey and Black Francolins in Yamuna Nagar District, Haryana : Preliminary Results

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The results presented here are a part of a three-year project on ecology of Grey francolin (*Francolinus pondicerianus*) and Black francolin (*Francolinus francolinus*) being carried out in Yamuna Nagar District (30° 12' N, 77° 18' E), Haryana. The study area was divided into nine blocks, which were further stratified into following four categories; forest, cultivation, grass and woody scrub. During October-December 2001, surveys were carried out to assess the habitat preference of these species, primarily using line transect and call count methods. The results revealed that both the francolin species appeared to show preference to agriculture areas dominated by sugarcane and wheat.

10. A Study on the Ecology (Population) and Behaviour of the Indian Peafowl (*Pavo cristatus*) in Vembakkotai, Virudhunagar District, Tamil Nadu

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A study on the ecology (population) and behaviour of the Indian peafowl (*Pavo cristatus*) was undertaken at Vembakkottai, a village situated at 14 km. south of Sivakasi, Virudhunagar District, Tamil Nadu. Twenty three visits were made from September 1995 to March 1996 and observations were made from 5.30 AM to 7.00 PM. The study period represented pre-breeding period (September), breeding period (October, November & December) and a post-breeding period (January, February & March). Four roosting sites were identified with in the study area. Sex ratio of adult male and female population at Vembakkkottai was found to be 100 :72. Harem formation, dancing, roosting, preening, standing, vocalization, feeding, breeding and tail shedding were the major behavioural activities of peafowl during the study period.

11. A Study on the Population and Behaviour of Indian Peafowl (*Pavo cristatus*) in Ketchilapuram Village, Tuticorin District, Tamil Nadu

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A study on the population and behaviour of Indian peafowl (*Pavo cristatus*) was undertaken in a 1 km^2 area in Ketchilapuram (9° 10'N-77° 52'E), a village in Kovilpatti Taluk, Tuticorin district, Tamil Nadu. During the 16 visits made between July 1998 and January 1999, a total of four roosting sites were identified within the area. Sex ratio of the species in the study area was estimated to be 1:0.76 (male: female). Seasonal variation in group composition and grouping pattern of peafowl in three different seasons of the study period was also observed. The breeding season of the peafowl started in the month of October. Harem formation, dancing, roosting, preening and vocalization were some of the behavioural activities of peafowl observed in the study area. Habitat destruction, poaching for meat and egg were the real threats to peafowl. In spite of the damage caused to the crops by peafowl, the villagers of Ketchilapuram tolerate the presence of the peafowl due to their religious sentiment. Suggestions for safeguarding our National bird at Ketchilapuram will be discussed

12. Social Organisation of the Nicobar Megapode (*Megapodius nicobariensis*) in the Great Nicobar Island

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The Nicobar megapode (*Megapodius nicobariensis*) is a mound nesting bird, endemic to Nicobar Islands. It is a primarily monogamous species, although temporary pair bonds, change in partner and extra-pair copulation are also observed in this species. During our study, unpaired megapodes tried to steal the mate from an existing pair and it led to changes in partnerships, extra-pair copulation and temporary pair bonding. An egg-laying pair showed dominance over a non-egg laying pair. The dominant rank in the society of the Nicobar megapode was not consistent. Hierarchy varies temporally and spatially. Alpha pairs were more likely to show mound and territory fidelity than Beta pairs. Territories overlapped where a large number of pairs used a mound. The average size of the territory was 0.8ha. A major function of the territory of the Nicobar megapode was to protect the mound from neighbours or strangers. Both partners of a pair equally defended their territory from others. In this paper, we discuss why is the Nicobar megapode monogamous? and we also attempt to explain the reasons for extra-pair copulation.

13. Conservation of Red Junglefowl in India - Problems and Initiatives

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The Red junglefowl (*Gallus gallus*) is undoubtedly the single most important bird species that has ever lived in this world due to its economic and cultural importance to human civilization. It is the wild ancestor of all the domestic chickens that forms the multi-billion dollar poultry industry of the world today. The Red junglefowl has not received due attention from conservationalists although it is the only fall back option in the event of loss of domestic varieties and/or avian diseases that could spell doom to the poultry industry. Recently, Peterson and Brisbin (1998) have expressed apprehensions that the wild Red junglefowl populations may have been genetically contaminated and that there may be no "pure" Red junglefowl in the wild. These observations were based on examination of 745 skins collected from various parts of Asia and preserved in various museums in America and Europe. The skins that were examined by the authors showed lack of phenotypic traits, which are characteristic to "pure" wild Red junglefowl. The phenotypic

traits include: eclipse plumage, hen comb, leg colour, spur, tail carriage, male's crown and clutch size. The authors contend that in the past, the wild Red junglefowl populations have hybridized with domestic or feral stock especially near the villages causing an introgression of domestic genes into the wild populations. We review their observations and hypotheses in the light of sampling distribution and sampling inadequacy. Irrespective of the above contentious issue, the threat to hybridization to the Red junglefowl in India is possible and may have affected wild populations. We present our initiatives in addressing this problem which includes our observations on the phenotypic traits of captive and wild Red junglefowl, and the development of a research project proposal to address the various aspects of this issue.

14. Husbandry, Management and Breeding Problems of Pheasants in Arignar Anna Zoological Park,Vandalur, Chennai

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Pheasants are large gamebirds, their males having an ornamental and elaborate plumage and unfeathered legs. The order galliformes comprises more than 200 species of which Arignar Anna Zoological Park has been maintaining 10 in captivity since its inception. They are *Francolinus pondicerianus*, *Galloperdix spadicea, Gallus sonneratii, Nemida meleagaris, Lophura leucomelana, Phasianus colchinus, Lophura nycthemera, Pavo cristatus, Catreus wallichi* and *Chysolophus pictus*. This paper explains the housing pattern, diet and day to day management aspects of pheasants in Arignar Anna Zoological Park. It has also discussed in detail about breeding problems of pheasants in captivity.

15. Breeding of Indian Peafowl (*Pavo cristatus*) in Arignar Anna Zoological Park, Chennai

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The Indian peafowl (*Pavo cristatus*) is a common and well-known National bird in India. The Arignar Anna Zoological Park is maintaining and breeding peafowls (normal and white-coloured) since its inception. This article explain in detail about courtship behaviour, egg laying, incubation, rearing and management of peafowl in captivity.

16. People's Participation in Conservation of Galliformes

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Wildlife Conservation is not possible without the support and involvement of local people living in and near the Protected Areas. Conservation of Galliformes in India depends substantially on the protection afforded to the species and their habitats by the local people. In India, many species of Galliformes are under serious threat due to hunting/poaching for meat or feathers; by habitat degradation; and disturbances during breeding season by human activities. Examples of such threats are presented and discussed with suggestions for People's participation in Conservation. Suggestions include: development of eco-tourism, alternate source of animal protein, cultivated plants substituting for wild plants/products from habitats of Galliformes, and creating general public awareness.

SUGGESTIONS AND RECOMMENDATIONS

It is suggested to start more Eco-clubs, in order to play a role in conservation of galliformes.

It is recommended that *Prosopis* scrub should be protected in order to safeguard the existence of peafowls in Pudukottai, Ramnad, Madurai and other parts of Tamilnadu.

The delegates from northern India felt that extensive surveys on Western tragopan should be carried out in Chamba district.

It is recommended that World Pheasant Association has to give priority for Awareness Education Campaign Programmes.

The delegates are of the opinion that the Important Bird Area has to collaborate with galliformes group.

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