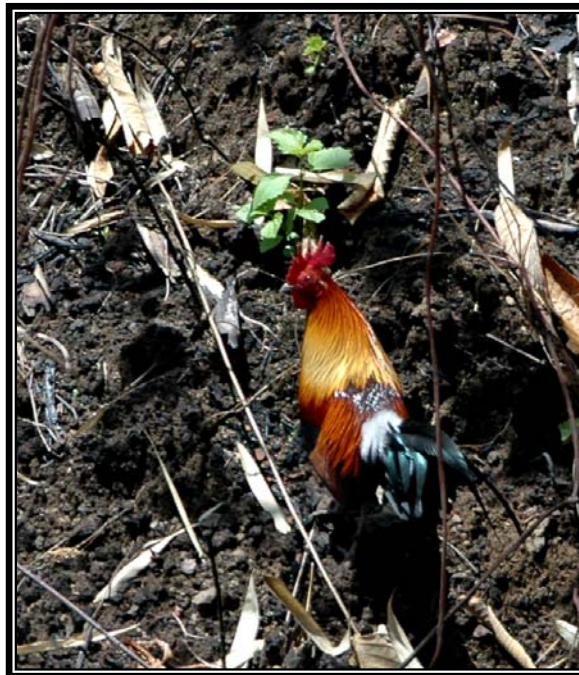




Nishorgo Support Project

Participatory Bird Survey to Assess Protected Area Management Impacts: *Second Year Report*



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Participatory Bird Survey to Assess Protected Area Management Impacts: *Second Year Report*

Prepared for

International Resources Group (IRG)

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With partners: CODEC, NACOM & RDRS



**Participatory Bird Survey to Assess Protected Area
Management Impacts: *Second Year Report***

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SUMMARY

Birds are the best indicators of ecological changes of their habitats. Hence, the birds of five mixed-evergreen forest sites under Nishorgo Support Project (NSP), located in the northeast and southeast of Bangladesh, were surveyed for the second year, from March to July 2006 (about 30 observation-days in the field). The members of Bangladesh Bird Club (BBC) and the local communities living around these sites had actively participated in the survey. The main objective of this survey was to assess NSP's protected area management impacts. Strip transect sampling and opportunistic survey methods were followed in the field.

Eight species of primarily forest birds were taken as indicators, and their population densities (no. of individuals/km²) in each of the five sites were estimated. The indicator birds were Red Junglefowl (*Gallus gallus*), Oriental Pied Hornbill (*Anthracoceros albirostris*), Red-headed Trogon (*Harpactes erythrocephalus*), Greater Racket-tailed Drongo (*Dicrurus paradiseus*), White-rumped Shama (*Copsychus malabaricus*), Hill Myna (*Gracula religiosa*), White-crested Laughingthrush (*Garrulax leucolophus*) and Puff-throated Babbler (*Pellorneum ruficeps*), and their respective densities in five NSP sites were estimated at: Lawachara National Park – 10.66, 13.21, 3.90, 31.93, 90.02, 21.19, 0.00, 29.55; Satchori National Park – 11.17, 14.88, 3.56, 33.69, 87.02, 13.00, 0.00, 36.16; Rema-Kalenga Wildlife Sanctuary – 12.02, 8.31, 2.15, 37.04, 64.94, 10.07, 0.00, 22.00; Chunati Wildlife Sanctuary – 14.50, 0.00, 0.00, 10.03, 23.99, 7.32, 5.77, 12.57; and Teknaf Game Reserve – 8.97, 11.12, 1.00, 37.34, 18.21, 32.51, 0.00, 17.39. When these were compared with the last year's estimates it was found that two of the indicator birds (Red Junglefowl and Puff-throated Babbler) that live in the understory of the forest have been significantly increased over the last year. This indicates that the forest understory has started regenerating, which increased the carrying capacity and nesting sites for these two species. The community patrolling, awareness programs and other activities by NSP played the key role in reducing the clearing of forest understory for firewood. This, however, should not be treated as an overall improvement of the forest condition, because the forest (particularly the tree cover) requires a long

time to complete the regeneration process. Hence, the improved protection to the forests must continue. Moreover, the illegal logging of timber trees and conversion of natural forests to monoculture plantations and agricultural fields still persists in some areas, which probably caused slight decline of the Oriental Pied Hornbill. This bird lives in the top canopy and hence is severely affected if the large trees are removed from the forest. The densities of other five indicator birds remained more or less unchanged over the last year.

A total of 219 species of birds was recorded in five NSP sites, of which 184 (84%) were resident and the rest 35 (16%) migrant. Out of 219 species, 37 (17%) were Very Common, 65 (30%) Common, 40 (18%) Uncommon and 77 (35%) Rare. This shows that the largest proportion of birds is Rare, which requires monitoring and conservation. No significant difference was found in the proportions of the number of species of primarily forest birds in relation to the total birds in the last year and in this year in each of the five NSP sites.

Chapter 1
INTRODUCTION

Participatory Bird Survey to Assess Protected Area Management Impacts: *Second Year Report*

1. INTRODUCTION

Birds are the best indicators of the ecological changes of their habitats, because they are relatively more visible and more responsive to any change. Different species of birds live in different strata of an area and are adapted to varied types of plant and animal food. Hence, the avian population density and species diversity strongly reflects the temporal changes of their habitat conditions. Taking these into account, participatory bird survey was taken as the tool to assess the protected area management impacts in Bangladesh.

Bangladesh is exceptionally rich in avifaunal diversity and abundance. Not only is the avifauna, Bangladesh is unique in its biodiversity of genetic resources, both wild and domestic. The genetic resources comprise forest resources, agricultural crops, wildlife resources and wetland resources. In an area of only 147,570 km², Bangladesh harbours over 660 species of birds (Harvey 1990), including about 250 migratory species. Moreover, new species often adds to the list. This can be compared with the total number of bird species in the whole Europe, or the United States, each of which is about 800. The total number of bird species recorded in Bangladesh is about 50% of the total of the Indian Subcontinent, and about 7% of the world's total (Harvey 1990).

Despite the exceptional richness of avian diversity, and biodiversity in general, the natural forests and other wilderness areas of the country are under great pressure of legal and illegal overexploitation. People living around the forests are largely dependant on the forest resources. Some people almost entirely subsist on the illegal harvest of the timber, bamboo and other forest products. The rate of forest loss in Bangladesh is one of the highest in the world. It is estimated that the forest

cover has been reduced to more than 50% since the 1970s (IUCN-Bangladesh 2000). Estimates in 1990 revealed that Bangladesh had less than 0.02 ha of forest land per person – one of the lowest forest to population ratios in the world (IUCN-Bangladesh 2000).

The urgent need to conserve the remaining natural forests and their inhabitants, while developing non-consumptive use of the forests at the same time, gave rise to a unique project, i.e. Nishorgo Support Project (NSP). This is a five-year project of the Forest Department (FD) of Bangladesh, which is financially supported by the United States Agency for International Development (USAID). The project is being implemented by the International Resources Group (IRG), with three local partners, i.e. Community Development Center (CODEC), Nature Conservation Management (NACOM), and Rangpur-Dinajpur Rural Services (RDRS). The project aims at improving the condition of the forest and biodiversity with active participation of the local communities. This will eventually develop a co-management system involving the local communities with the Forest Department.

The project has taken five protected areas in the mixed-evergreen forests located in the northeast (Lawachara National Park, Satchori National Park and Rema-Kalenga Wildlife Sanctuary) and southeast (Chunati Wildlife Sanctuary and Teknaf Game Reserve) of Bangladesh. Very few studies have taken place on birds of the mixed-evergreen forests of the country. The first report on the birds of a mixed-evergreen forest region of Bangladesh (Chittagong) was by Simmons (1948). Later on, Husain (1968) reported the birds of Chittagong Hill Tracts, Das (1973) studied the birds of Sylhet, Choudhury (1979) listed the wildlife (mammals and birds) of Chittagong Hill Tracts; Husain (1975), and Husain and Haque (1976) reported the birds of Pablakhali Wildlife Sanctuary, Chittagong Hill Tracts; and Husain *et al.* (1990) reported the birds of Dulahazara Safari Park, Cox's Bazar. Rashid (1967), Husain (1967, 1979), Khan (1982), Sarker and Sarker (1988), Harvey (1990), and Thompson and Johnson (1996) have produced lists of birds in Bangladesh where they have indicated that many of the species are found in the mixed-evergreen forests. Subsequent reports on notable birds (Thompson *et al.* 1993, Thompson and Johnson 2003) have updated the knowledge of the status

and distribution of many species of birds found in the mixed-evergreen forests of Bangladesh.

Like any other projects, this project requires an assessment of the level of success or failure. Systematic annual surveys on the population density of some selected indicator birds and the status of avian species diversity and composition came as the most convenient and useful tool for the assessment. This is also a way to enrich our understanding and knowledge about the birds living in the mixed-evergreen forests. The participatory bird survey had the following aims –

- Develop a coordinated approach for the survey of population density of several selected species of birds, and the overall bird species diversity and composition, to assess the protected area management impacts.
- Train the participants of the survey team about the survey method and identification of birds.
- Raise awareness for rare birds in need of more effective management/conservation efforts.
- Raise awareness of the general public, especially the stakeholders living around the project sites, to the status of birds and the importance of conservation.

Chapter 2
PROJECT SITES

2. PROJECT SITES

A total of five protected areas were selected for NSP activities from the northeast and southeast of Bangladesh. Bangladesh is a small sub-tropical country in South Asia. The country became independent in 1971. Geographically the country is located between 20°34'-26°33' N latitudes and 88°01'-92°41' E longitudes. The Tropic of Cancer passes through the middle of the country. Bangladesh is almost entirely surrounded by India, which borders Bangladesh to the west, north and east. Bangladesh shares a portion of its southeastern border with Myanmar (Burma). The Bay of Bengal lies to the south. The total area of the country is 147,570 km², where around 140 million people live. This is one of the most densely populated areas in the world.

According to IUCN-Bangladesh (2000), the climate of Bangladesh is tropical monsoon, characterised by marked seasonal variations. Abundant rainfall during the monsoon (July-October) is followed by a cool winter period (November-February), then a hot and dry summer (March-June). In the hot season, the average maximum and minimum temperatures are 34°C and 21°C, respectively. The average maximum and minimum temperatures in winter are 29°C and 11°C, respectively. The rainfall in the region shows great temporal and spatial variations. It is estimated that 70-80% of the annual rainfall occurs during the monsoon season. The average annual rainfall recorded within Bangladesh varies from 1,100 mm in the extreme west to 5,690 mm in the northeastern corner of the country.

Bangladesh has an exceptional hydrological setting. Three mighty rivers, the Ganges (Padma), the Brahmaputra (Jamuna) and the Meghna, drain a catchment extending over India, China, Nepal, Bangladesh and Bhutan. The total area of the Ganges-Brahmaputra-Meghna drainage basin is about 1,500,000 km², of which about 62% is in India, 18% in China, 8% in Nepal, 8% in Bangladesh, and 4% in Bhutan. Ninety percent of the total incoming water runs into the Bay of Bengal through the lower Meghna estuary of Bangladesh. The rate of water flow through Bangladesh is vast. The outflow is the second in the world after the Amazon river

system in South America. In both breadth and total annual volume, the Padma-lower-Meghna river is the 3rd largest in the world.

Bangladesh can be divided into three main physiographic divisions – Tertiary hills, Pleistocene terraces and recent plains. The Tertiary hills are situated in Greater Chittagong and Chittagong Hill Tracts, and Sylhet areas. These hills are mainly formed of sandstone, shale and clay. The average altitude of the hills is 450 m. The highest peak of the country is Keokradong at 967 m. The Pleistocene terraces were formed 25,000 years ago. The total area of these terraces is about 13,500 km² spread in different areas of the country, but mainly in the central and northeastern regions. The average height of the terraces from the adjacent floodplains is 6-25 m. The recent plains comprise 124,266 km² of the country (about 86%), i.e. the major portion of Bangladesh, and these can be further classified to piedmont, flood, deltaic, tidal and coastal plains.

According to the Forestry Master Plan (Ministry of Environment and Forests, Government of Bangladesh, 1993), there are 15.4% of the total area of the country are forests, of which 10.3% are classified and 5.1% are unclassified state forests, but according to unofficial sources, the natural forest of the country is as low as 5%. There are three classes of natural forests in Bangladesh: a) mangrove forests – situated in the southwest, b) mixed-evergreen forests – situated in the northeast and southeast, and c) moist deciduous forest – situated in the central, northern and northwestern regions of the country (Figure 1). In the past three decades, the stock of forest trees has declined at an alarming rate. There are 23 protected areas and other conservation sites in Bangladesh (Table 1), with a total area of 2,504.3 km², covering only 1.7% of the total area of Bangladesh.

The country has a rich biological heritage as a consequence of its location at the confluence of the three major biotic regions – the Himalayas, Indo-China and the Indian Peninsula (MacKinnon and MacKinnon 1986). Up to the year 2000, a total of 259 inland fishes, 442 marine fishes, 22 amphibians, 108 inland reptiles, 17 marine reptiles, 391 resident birds, 240 migratory birds, 110 inland mammals and 3 marine mammals have been recorded in Bangladesh (IUCN-Bangladesh 2000).

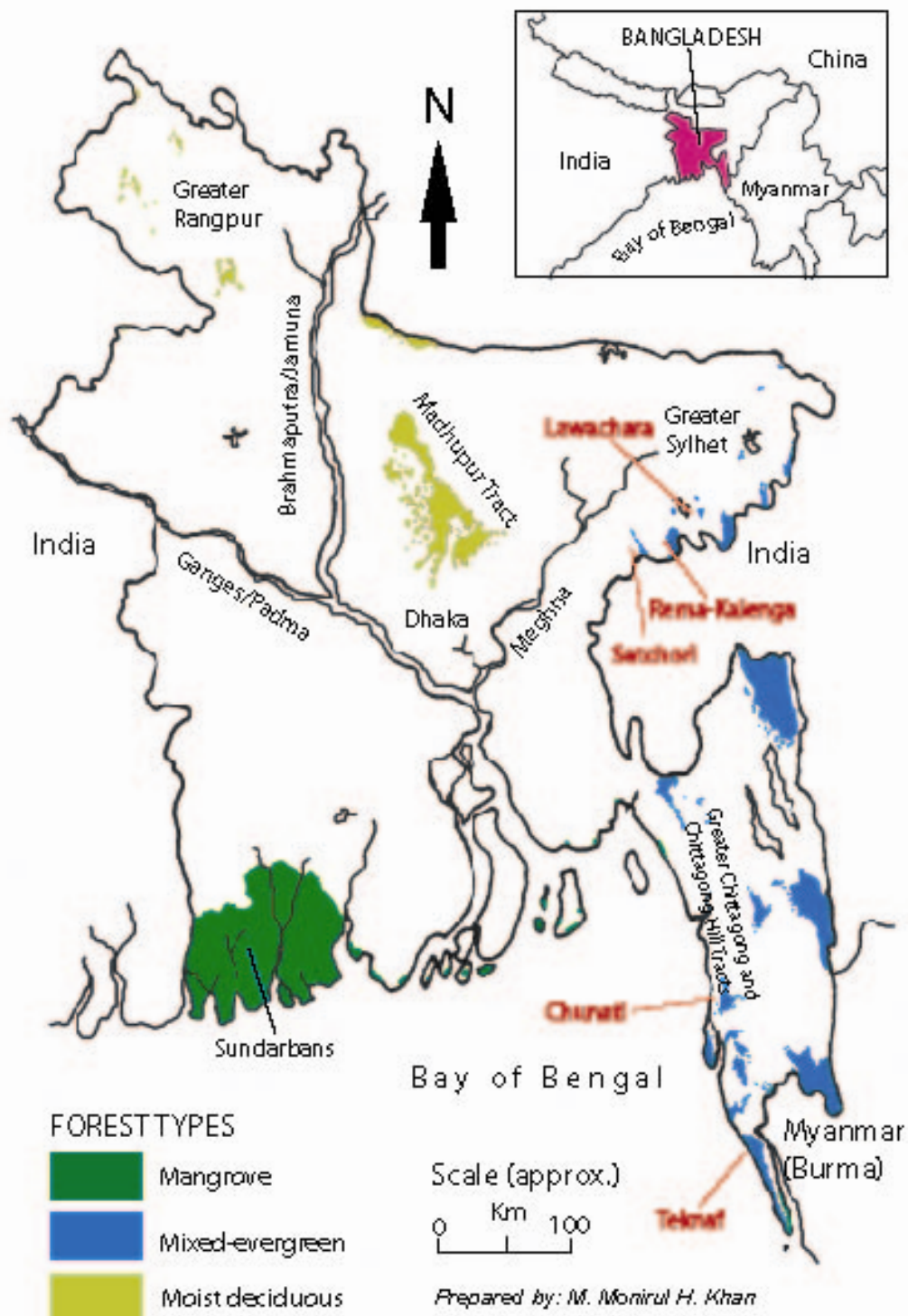


Figure 1. Forested areas of Bangladesh showing the locations of five sites under Nishorgo Support Project (NSP).

Table 1. Protected areas (National Parks, Wildlife Sanctuaries and Game Reserves) and other conservation sites (Eco-Parks and Safari Parks) in Bangladesh

Sl. No.	Name of the Area	Type of Area	Geographical Location (Approx.)	District in Which Located	Year of Establishment (Extension)	Area (ha)
National Park						
1	Madhupur	Moist Deciduous Forest In Hillocks	24°45' N Latitude, 90°06' E Longitude	Tangail And Mymensingh	1962 (1982)	8,436
2	Bhawal	Moist Deciduous Forest In Hillocks	24°45'00' N Latitude, 90°20' E Longitude	Gazipur	1974 (1982)	5,022
3	Himchari	Mixed-Evergreen Forest In Hills	21°22' N Latitude, 92°02' E Longitude	Cox's Bazar	1980	1,729
4	Lawachara	Mixed-Evergreen Forest In Hills	24°15' N Latitude, 91°45' E Longitude	Moulvibazar	1996	1,250
5	Kaptai	Mixed-Evergreen Forest In Hills	22°30' N Latitude, 92°20' E Longitude	Rangamati	1999	5,464
6	Nijhum Dweep	Mangrove Forest On Coastal Island	25°35' N Latitude, 88°45' E Longitude	Noakhali	2001	16,352
7	Ramsagar	Huge Lake Surrounded By Plantation	24°45' N Latitude, 90°06' E Longitude	Dinajpur	2001	27
8	Medha Kachhapia	Dipterocarp Forest In Hillocks	21°35' N Latitude, 92°02' E Longitude	Cox's Bazar	2004	395
9	Satchari	Mixed-Evergreen Forest In Hills	24°07' N Latitude, 91°27' E Longitude	Habiganj	2006	242
Wildlife Sanctuary						
1	Sundarbans East	Mangrove Forest In Lowland Coast	21°47'-22°03' N Latitudes, 89°44'-89°56' E Longitudes	Bagerhat	1960 (1996)	31,226
2	Pablakhali	Mixed-Evergreen Forest In Hills	23°08' N Latitude, 92°16' E Longitude	Rangamati	1962 (1983)	42,087
3	Char Kukri-Mukri	Mangrove Forest On Coastal Island	21°55' N Latitude, 90°38' E Longitude	Bhola	1981	40
4	Chunati	Dwarf Bamboo And Other Vegetation In Hills	21°40' N Latitude, 92°07' E Longitude	Chittagong And Cox's Bazar	1986	7,761
5	Sundarbans South	Mangrove Forest In Lowland Coast	21°39'-21°56' N Latitudes, 89°17'-89°30' E Longitudes	Khulna	1996	36,970
6	Sundarbans West	Mangrove Forest In Lowland Coast	21°38'-21°58' N Latitudes, 89°00'-89°15' E Longitudes	Satkhira	1996	71,502
7	Rema-Kalenga	Mixed-Evergreen Forest In Hills	24°05' N Latitude, 91°37' E Longitude	Habiganj	1996	1,795
Game Reserve						
1	Teknaf	Mixed-Evergreen Forest In Hills	21°00' N Latitude, 92°20' E Longitude	Cox's Bazar	1983	11,615
Eco-Park						
1	Madhutilla	Moist Deciduous Forest In Hillocks	25°12' N Latitude, 90°10' E Longitude	Sherpur	1999	100
2	Madhabkunda	Mixed-Evergreen Forest In Hills	22°30' N Latitude, 92°20' E Longitude	Moulvibazar	2000	253

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3	Sitakunda	Mixed-Evergreen Forest In Hills	22°30' N Latitude, 92°20' E Longitude	Chittagong	2000	403
4	Banshkhali	Dwarf Bamboo And Other Vegetation In Hills	21°58' N Latitude, 91°59' E Longitude	Chittagong	2003	1,200
5	Kuakata	Mangrove Forest In Lowland Coast	20°50' N Latitude, 90°10' E Longitude	Patuakhali	2006	5,661
Safari Park						
1	Dulahazara	Dipterocarp Forest In Hillocks	21°39' N Latitude, 92°03' E Longitude	Cox's Bazar	1997	900
Total protected area and conservation sites = 250,430 ha or 2,504.3 km²						

A total of five sites were initially selected for the implementation of NSP, of which two are national parks (Lawachara and Satchori), two wildlife sanctuaries (Rema-Kalenga and Chunati) and one game reserve (Teknaf). All of these areas are located in the mixed-evergreen forest belts in the northeast (Habiganj and Moulvibazar Districts) and southeast (Chittagong and Cox's Bazar Districts), although the mixed-evergreen forests have largely been destroyed and converted, these areas still have some rich patches of mixed-evergreen forests. Recently, a new site (Banshkhali Eco-Park, Chittagong) has been added, but field activities are yet to start in full-swing. The five sites where the bird survey took place are –

2.1 Lawachara National Park

This is an area of 12.5 km² situated in Srimangal and Kamalganj Upazillas (sub-districts) of Moulvibazar District (Figure 2). The core area is an excellent compact forest of old plantations dating from the 1920s, which has now mixed up with naturally generated vegetation and the entire area now resembles a natural forest. Most of the species are of evergreen type, dominated by 'chapolish' (*Artocarpus chaplasha*), 'civit' (*Swintonia floribunda*), 'shimul' (*Bombax insignis*), fig (*Ficus* spp.), 'jam' (*Syzygium* spp.) and bamboo (*Bambusa* spp. and *Melocanna* spp.). This is one of the most popular birding areas of the country. However, the core area of this forest is surrounded by monoculture plantations of teak (*Tectona grandis*) and malakana (*Albizia malakana*), which are not good habitats for birds. Lawachara is the best forest to watch the Hoolock Gobbler (*Bunipithecus hoolock*). Other important wildlife are Capped Langur (*Trachypithecus pileatus*), Phayre's Langur (*Trachypithecus phayrei*), Pig-tailed Macaque (*Macaca nemestrina*), Orange-bellied Himalayan Squirrel (*Dremomys lokriah*), Barking Deer (*Muntiacus*

muntjac) and Masked Civet (*Paguma larvata*). The surrounding habitans are mainly of Khasia tribal communities. These people often harvest the forest resources, but their main subsistence is the cultivation of betel leaf, lemon and pineapple. Some of them work in the nearby tea estates. The forest is surrounded by tea estates. Magurchara Gas Field and the gas processing plant are in two ends of the National Park. There are six transects for bird survey in this forest, which are given in Table 2.

2.2 Satchori National Park

This is a small patch (2.4 km²) of intact mixed-evergreen forest located in Chunarughat Upazilla of Habiganj District (Figure 3). The area is roughly resembles a triangle, with one angle ended towards Bangladesh-India border. The forest stands on an area that had a forest even thousands of years ago. Fossilized tree trunks are often found in the area. At present the forest is dominated by 'chupalish' (*Artocarpus chaplasha*), 'civit' (*Swintonia floribunda*), 'shimul' (*Bombax insignis*), fig (*Ficus* spp.) and bamboo (*Bambusa* spp. and *Melocanna* spp.). Satchori is the area where the Asiatic Black Bear (*Ursus thibetanus*) is seen quite frequently, and also reported to breed in nearby grassland (Chan Khola). Other important wildlife are Hoolock Gibbon (*Hylobates hoolock*), Pig-tailed Macaque and Barking Deer (*Muntiacus muntjak*). There is only one village of ethnic Tripura tribes, living at the border of the forest. They cultivate lemon and pineapple in the hills, and work in the tea estates. The bamboo and other forest products are illegally harvested mainly by 'Bangalis' coming from outside. The forest is almost entirely surrounded by tea estates. There are three transects for bird survey in this forest, which are given in Table 2.

2.3 Rema-Kalenga Wildlife Sanctuary

This is probably the most remote site among five NSP sites, but this remoteness is probably the main reason why such a luxuriant patch of mixed-evergreen forest still exists. It requires about 10 km of risky drive through damaged roads of the hill forests. This is an elongated strip of land along the Bangladesh-India border. The

total area is 18.0 km² in Chunarughat Upazilla of Habiganj District (Figure 4). A nice watchtower is situated at the northwestern end of the Sanctuary (24°10.7' N latitude and 91°37.6' E longitude), besides a wetland. This is mainly a natural forest of evergreen trees mixed with some deciduous trees, but there are some pockets of grasslands and ditches that make the habitat more diverse and suitable for wildlife. The forest is dominated by 'chupalish' (*Artocarpus chaplasha*), 'civit' (*Swintonia floribunda*), 'shimul' (*Bombax insignis*), 'jam' (*Syzygium* spp.), fig (*Ficus* spp.), 'hargaza' (*Dillenia pentagyna*) and bamboo (*Bambusa* spp. and *Melocanna* spp.). Rema-Kalenga is the forest where the Malayan Giant Squirrel (*Ratufa bicolor*) is seen very often. Other important wildlife of the area are Leopard (*Panthera pardus*), Phayre's Langur (*Trachypithecus phayrei*) and Masked Civet (*Paguma larvata*). The people live around this Sanctuary are mainly non-tribal 'Bangalis', but there are people of ethnic Tripura, Khasia and Orang tribes as well. Their livelihood depends mainly on the cultivation of paddy in the nearby plain lands and working in the nearby tea estates. There are four transects for bird survey in this forest, which are given in Table 2.

2.4 Chunati Wildlife Sanctuary

Although this Sanctuary is quite big (77.6 km²), ecologically this is the poorest among five NSP sites. It is located in Lohagara and Banhskhali Upazillas of Chittagong District and Chakaria Upazilla of Cox's Bazar District (Figure 5). There are two partially damaged watchtowers at the top of two hills (21°55.3' N latitude and 92°02.7' E longitude), one beside the other. The hills are quite high (50-100 m from the sea level). These hills were once covered by giant trees like 'garjan' (*Dipterocarpus* spp.) and 'chupalish' (*Artocarpus chaplasha*), but now they have almost entirely been cleared out by illegal felling. Only in Banopukur area of the Sanctuary, a small patch of giant 'garjan' still stands to remind us that once there were many trees in that area. Today the hills are covered mainly by a number of species of dwarf bamboo (*Melocanna* spp., *Bambusa* spp. and *Teinostachyum* spp.), reeds (*Phragmites* spp., *Saccharum* spp., etc.), wild banana (*Musa* spp.) and many other dwarf and scrubby vegetation. The most important wildlife of the area is the Asian Elephant (*Elephas maximus*), but there are Wild Boar (*Sus*

scrofa), Rhesus Macaque (*Macaca mulatta*) and some other wildlife as well. The habitants of the area are non-tribal 'Bangalis'. Their main subsistence is agriculture (paddy, lemon and betel leaf) and fish farming, but some of them illegally harvest the bamboo and other forest products. There are five transects for bird survey in this Sanctuary, which are given in Table 2.

2.5 Teknaf Game Reserve

This is the largest (116.2 km²) and most undulated area, with steep terrain, among the five NSP sites (Figure 6). This Reserve was established in order to manage the game animals. According to the Bangladesh Wildlife Act 1974, a permit-holder can hunt game animals in a Game Sanctuary, but there is no legal game hunting in this area despite the fact that this is the only Game Sanctuary of the country. The hills are much higher than that of the other four sites, with the heights of 100-150 m from the sea level. The Toynga is the highest hill in the areas we surveyed, with the height of 200 m altitude. Other than the wildlife and plants, there are three tourist attractions in this Game Reserve. In Toynga Hill there is a wonderful cliff called Cooty (21°04.5' N latitude and 92°11.9' E longitude). In ancient time this was a sea-bed (salt layers and marine shells are found in the deposits), which is now at a high hill, showing different layers of sand deposits on a concave surface. In the same hill there is a small waterfall (21°04.9' N latitude and 92°11.7' E longitude). In the northern end of the Game Reserve there is a natural cave called Kudum Cave (21°05.2' N latitude and 92°10.2' E longitude), located in Kudum Hill. The area still has some luxuriant patches of mixed-evergreen forests, with tall 'civit' (*Swintonia floribunda*), 'chaplalish' (*Artocarpus chaplasha*), 'garjan' (*Dipterocarpus* spp.), 'shimul' (*Bombax insignis*), 'uriam' (i.e. wild mango, *Mangifera longipes*), fig (*Ficus* spp.) and many other trees, including 'ashok' (*Saraca indica*), a popular medicinal plant. Among the wildlife, Asian Elephant (*Elephas maximus*) is the most important, but there are Wild Boar (*Sus scrofa*), Clouded Leopard (*Neofelis nebulosa*), Hog-badger (*Arctonyx collaris*) and many other wildlife. The people live around this area are non-tribal 'Bangalis', with some ethnic Chakma and Mogh tribes. There are five transects for bird survey in this forest, which are given in Table 2.

Table 2. Strip transects in five sites of Nishorgo Support Project (NSP)

Name of Project Site	Name of Transect	Location in Project Site	Geographic Locations of Two Ends	Landmarks at Two Ends	Length (km)
Lawachara National Park	Magurchara	Eastern	24°19.9' N, 91°47.6' E; 24°20.2' N, 91°47.5' E	Gasfield, stream	0.50
	Train Line	Central	24°19.7' N, 91°47.2' E; 24°19.8' N, 91°47.5' E	Signboard, metalled road	0.61
	Rest House	Central	24°19.8' N, 91°47.2' E; 24°20.2' N, 91°47.2' E	Sharp turn, culvert	0.50
	Tea Estate	Central	24°19.5' N, 91°47.2' E; 24°19.7' N, 91°47.6' E	Bus stand, tea estate	0.70
	Lawachara Punji	Western	24°19.2' N, 91°47.1' E; 24°19.4' N, 91°46.8' E	Three large trees, betel-leaf plantation	0.52
	Jankichara	Western	24°18.8' N, 91°46.4' E; 24°19.1' N, 91°46.9' E	Jankichara Forest Office, 'Mofi' Point	0.89
Satchori National Park	Satchori West	Central	24°07.5' N, 91°26.7' E; 24°06.6' N, 91°27.2' E	'Wilderness' signboard, teak plantation	1.94
	Satchori East	Central	24°07.6' N, 91°27.0' E; 24°07.3' N, 91°27.2' E	Sloppy passage, open grassland	0.56
	Satchori North	Northern	24°07.4' N, 91°26.7' E; 24°07.5' N, 91°27.0' E	Lemon plantation, metalled road	0.50
Rema-Kalenga Wildlife Sanctuary	Watchtower	Northern	24°10.7' N, 91°37.6' E; 24°09.6' N, 91°38.0' E	Watchtower, Chharabari	2.02
	Chharabari	Central	24°09.6' N, 91°38.0' E; 24°09.8' N, 91°37.5' E	Chharabari, paddy field	0.78
	Chhanbari	Northern	24°10.2' N, 91°37.5' E; 24°10.3' N, 91°37.9' E	Chhanbari, slope	0.80
	Rema	Southern	24°06.9' N, 91°37.5' E; 24°06.4' N, 91°37.8' E	Large 'chapolish' tree, BDR camp	1.11
Chunati Wildlife Sanctuary	Two Towers	Eastern	21°55.4' N, 92°03.5' E; 21°55.3' N, 92°02.7' E	Metalled road, second tower	1.41
	Banyan Tree	Central	21°55.3' N, 92°02.7' E; 21°55.5' N, 92°02.3' E	Second tower, banyan tree	0.76
	Hindur Jhiri	Eastern	21°55.7' N, 92°02.5' E; 21°56.1' N, 92°03.5' E	Hindur Jhiri, brick field	1.91
	Banopukur South	Northern	21°57.3' N, 92°04.1' E; 21°57.2' N, 92°03.7' E	Mosque, western 'garjan'	0.65
	Banopukur North	Northern	21°57.2' N, 92°03.7' E; 21°57.4' N, 92°04.0' E	Western 'garjan', farm	0.65
Teknaf Game Reserve	Kudum North	Northern	21°05.8' N, 92°09.8' E; 21°05.2' N, 92°10.2' E	NSP signboard, Kudum cave	1.25
	Kudum South	Northern	21°05.2' N, 92°10.2' E; 21°05.4' N, 92°09.5' E	Kudum cave, mahogany plantation	1.27
	Shukna Amtoli	Northern	21°06.3' N, 92°11.7' E; 21°05.5' N, 92°10.8' E	Dead banyan tree, 'jhum' cultivation	0.74
	Toynga	Central	21°05.2' N, 92°11.9' E; 21°03.9' N, 92°11.6' E	Wooden bridge, Toynga Hill peak	2.49
	Cooty	Central	21°03.9' N, 92°11.6' E; 21°04.5' N, 92°11.9' E	Toynga Hill peak, Cooty cliff	1.21

Chapter 3
MATERIAL AND METHODS

3. MATERIAL AND METHODS

3.1 Material Used

Since the survey was conducted through simple methods, no sophisticated equipment was needed for the data collection and analyses. A few things were required in the field, such as some binoculars (8-10x) for better observation and identification of birds, books (field guides) on birds for identification, a GPS (Geographic Positioning System; E-trex Vista C) to mark the start and end points of each transect, and to measure the distance of each transect, a compass to make sure that the survey team is walking straight (roughly), and standard data sheets (see Appendix I) to record the raw data in the field. Moreover, for professional photographs and video clips, two Nikon D70S digital camera bodies, two Nikkor lenses (300 mm and 28-105 mm), one Nikon SB-800 flashgun, one Panasonic NVGS-11 MiniDV with a tripod were used.

3.2 Selection of Indicator Birds

A total of eight species of birds were selected as indicators for assessment of the overall condition of the wilderness (Table 3). As per the framework proposed by Nasim Aziz (NSP-Monitoring Specialist), these eight species were suggested on a meeting of bird experts (including Enam Ul Haque and Paul Thompson), organised in IRG. These birds were selected because: 1) these are primarily forest birds, 2) each of these lives in different layers of the forest, 3) these are noisy birds, so easy to spot, and 4) these are resident birds.

Table 3. Eight indicator bird species of different layers of the forest

Sl. No.	English Name	Scientific Name	Forest Layer Where it Lives
1	Red Junglefowl	<i>Gallus gallus</i>	Lower
2	Oriental Pied Hornbill	<i>Anthracoceros albirostris</i>	Upper
3	Red-headed Trogon	<i>Harpactes erythrocephalus</i>	Middle
4	Greater Racket-tailed Drongo	<i>Dicrurus paradiseus</i>	Middle
	White-rumped Shama	<i>Copsychus malabaricus</i>	Middle
6	Hill Myna	<i>Gracula religiosa</i>	Upper
7	White-crested Laughingthrush	<i>Garrulax leucolophus</i>	Lower
8	Puff-throated Babbler	<i>Pellorneum ruficeps</i>	Lower

3.3 Survey Team

The survey team was formed by participants from Bangladesh Bird Club (BBC) and the local communities living around or close to the project sites. BBC is an informal club of active amateur birdwatchers who are based in Dhaka, but frequently visit the wilderness areas of the country. Mr. Enam Ul Haque, the prominent birdwatcher of the country is the informal leader of BBC. The whole survey team was lead by a wildlife expert (Dr M. Monirul H. Khan) from Jahangirnagar University, Savar, Dhaka. See Appendix II for the names and addresses of the survey team members.

3.4 Training Program on Bird Survey

A three-day training program was organized on bird survey in Srimangal, Moulvibazar, where the participants were either Scouts or Rovers from the locality and from Dhaka. The training program was conducted in the classroom as well as in the forest (Lawachara). Dr M. Monirul H. Khan was the main resource person for the training program, but people from NSP (Kazi M.A. Hashem and Nasim Aziz), BBC (Mustafezur Rahman and Samiul Mohsanin) and the local partner NGOs (CODEC, NACOM and RDRS) were also involved as resource persons. See Appendix III for an English version of the training manual that was followed in the training program (the Bengali version was used and distributed among the participants). Most of the participants had school- or college-level education. The training program mainly covered the following aspects –

- Introduction and objectives of the bird survey
- Methods of estimating bird population density (different methods considered were discussed in brief, but strip transect sampling and opportunistic survey was discussed in detail, because these were the selected methods)

- Bird identification (topography of a bird, variable structures and colors of different parts of bird body, how to observe)
- Description of eight indicator bird species (their shape, size, colour, call and habits)
- Open discussion
- Practical demonstration in the field and experimental survey
- Assessment of perception of the participants.

3.5 Bird Survey Methods

The bird survey was first started in the last year (2005), and before the starting of the fieldwork, a number of methods were considered, but two methods were finally selected for the survey (Table 4). The methods were selected on the basis of simplicity and effectiveness, so that even the uneducated local people can do the survey and produce indicative results. It was decided that the survey should be conducted in the breeding season of birds (February-July), so that there are more activities of birds. One of the main objectives of this project is to involve local and other communities in all activities, including the monitoring, so that they feel ownership of the project, and even they themselves can do the survey if they want to do so. Hence it was not very easy to design survey methods that would be simple and feasible, yet reliable to indicate the change in the population density of some indicator birds, and the species diversity and composition of birds, which in turn will indicate the level of success or failure of NSP. Taking all these into account, strip transect sampling and opportunistic survey methods were selected. The survey was conducted last year (February-June 2005), when the baseline data were collected. This year (March-July 2006) the same survey has been repeated in the same areas, repeating the same transects, so that the results could be compared with that of the last year.

Table 4. Different methods considered for bird survey

Method	Description	Suitability	Decision
Quadrat sampling	Objects are counted from sample quadrats	Suitable for population estimation of less mobile or immobile organisms, e.g. earthworms, plants	Rejected
Strip transect sampling	A combination of quadrat sampling and line transect sampling where objects are counted from straight, long and narrow strips	Suitable for population estimation of visible organisms, no problem for mobile organisms, requires no expert knowledge	Accepted
Line transect sampling	Objects are counted from two sides of a straight line; no restriction of distance while observing, but the sighting distance and sighting angle for each observation must be recorded	Suitable for population estimation of visible organisms, no problem for mobile organisms, but requires expert knowledge and use of DISTANCE software	Rejected
Point transect sampling	It may be considered as a line transect of zero length (i.e. a point) where the sighting (radial) distance of each of the objects are measured from random points	Suitable for areas where transect sampling is difficult due to inaccessibility; no problem for mobile organisms (if visible), but might not sufficiently cover the habitat diversity	Rejected
Opportunistic survey	Any important observation or information is recorded whenever available without following any systematic way	Suitable for recording the species diversity, composition and other important information, but not for population density	Accepted

3.5.1 Strip Transect Sampling

Strip transect sampling (Buckland *et al.* 2001) was found most suitable to estimate the population density of eight indicator bird species. This method is simple, so even the local communities can do it without the help of an expert. In this method the observer(s) slowly walk (ca. 1.5 km/hr) on a relatively straight line through the study area and count the objects from both sides. The observation-range varies depending on the visibility of the study area. For mixed-evergreen forests of Bangladesh, the observation-range of 20 m on each side of the centreline would be suitable. The initial location of the object is always considered, because the object might move away after watching the observer(s). If any object is sighted

beyond the pre-decided observation-range, or if the object is coming from the back (in order to avoid duplication), the observation is not recorded. The survey is conducted in early mornings and late afternoons when the birds are most active. Transects are located in areas which are suitable in terms of accessibility and observation.

Each strip transect count is actually the total count of an area of the strip [length of the strip X width of the strip (2 X observation-range)]. Suppose there are k number of strips, each of width $2w$ (w is the observation-range on either side of the centreline), and the total length of all strips (same strips repeated are treated as new strips) is L in a study area. If the total number of recorded objects in all strips is n , the population density D is estimated by –

$$D = n/2wL$$

Since the project sites are not very big, it was not possible to make very long or many transect lines in the project sites. Hence, each transect was repeated for three times, but each of them were treated as a new transect, i.e. a new k . Notably, the birds are highly mobile, so when a transect is repeated, differential counts of birds are recorded.

This method assumes that all objects in the strip are recorded, so the observer(s) were very careful in observing and recording the objects. Even then, the observer(s) might have missed some of the objects in the strip, but if it is not more than 5% of the total objects recorded, the error is statistically negligible. The more areas covered in strip transects, the less error in the result will be. The transects were located mainly in the rich parts of the NSP sites. Even if any centreline of a transect was slightly undulated, the observation-strip was maintained straight (roughly) by manipulating the observation distance to that particular area. The birds were observed and identified properly and correctly, so that there is no misidentification. The main weakness of this method is that the error cannot be estimated.

3.5.2 Opportunistic Survey

In opportunistic survey, any important or interesting observation/information is recorded at any time while in the field. This method is suitable for recording the occurrence, relative abundance and distribution of different species of birds and other wildlife. The birds were identified by following some authentic books (Ali and Ripley 1987, Grimmet *et al.* 1998, 1999; Grewal *et al.* 2002). The relative abundance of birds was assessed by direct observation in the field and by interviewing local people. The 'resident' bird is defined as the species always lives in Bangladesh and normally breeds in Bangladesh and the 'migrant' bird is defined as the species that does not live in Bangladesh all through the year and normally breeds elsewhere. Some species make significant local movements and they have been designated as local migrants.

Although the opportunistic survey is an informal way of collecting information, the outcome can be very useful. However, if this is not carried out with sufficient care, wrong information can be recorded and the results can be biased. This method gives the opportunity to record scattered but important observations and information on rare and threatened birds and other wildlife, which could not be studied formally due to their rarity. The following aspects were recorded for birds

–

- Occurrence of a species, with its relative abundance
- Breeding season (mating, nesting, feeding young, etc.)
- Food materials
- Calls or songs
- Threats (lack of food, lack of nesting place, lack of habitat, hunting and trapping, etc.)

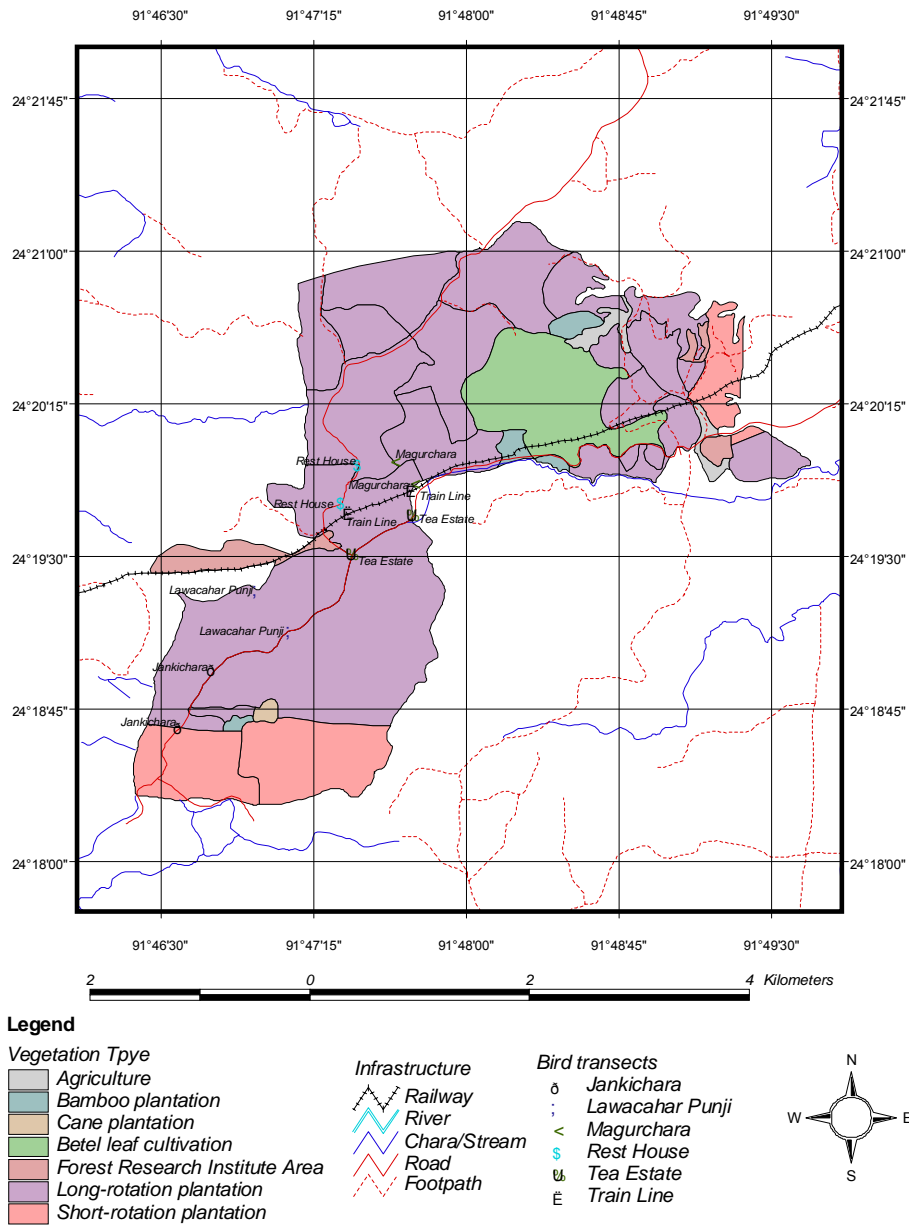


Figure 2. Lawachara National Park showing the starting and ending points of bird survey transects

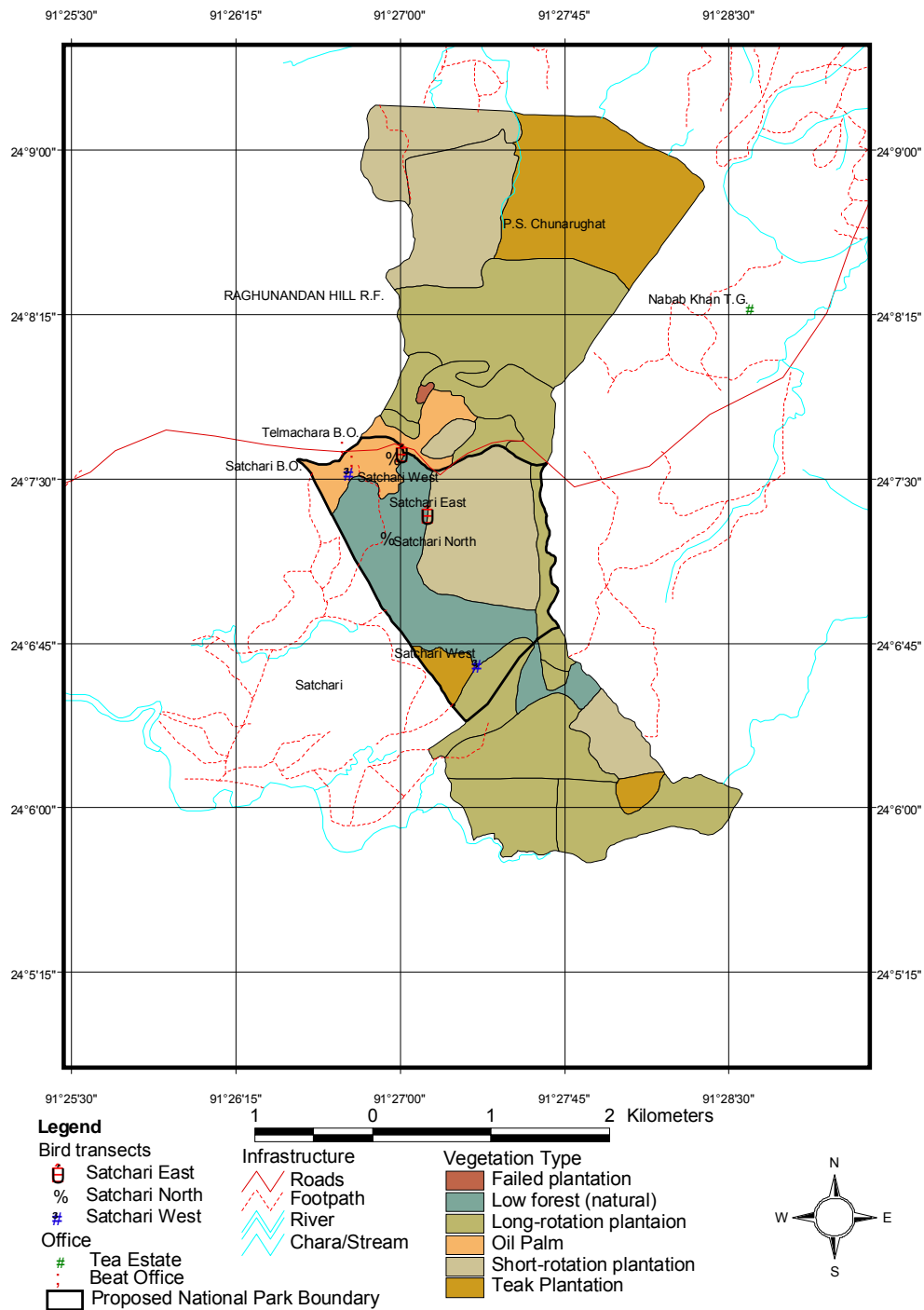


Figure 4. Satchori Reserve Forest showing the starting and ending points of bird survey transects

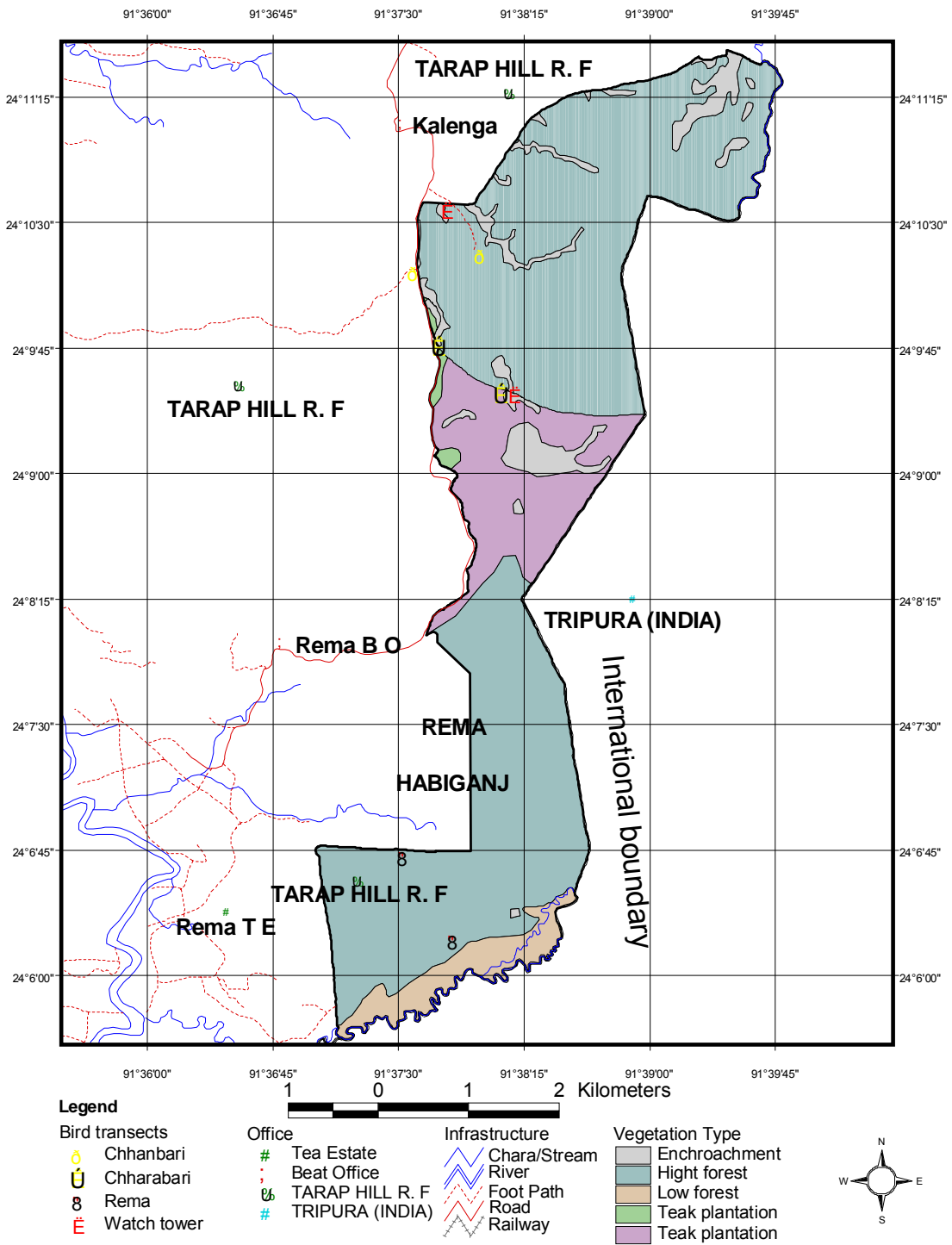


Figure 3. Rema-Kalenga Wildlife Sanctuary showing the starting and ending points of bird survey transects

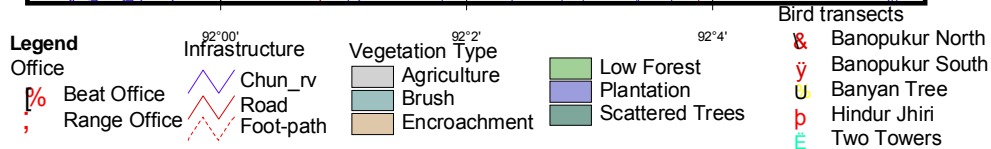
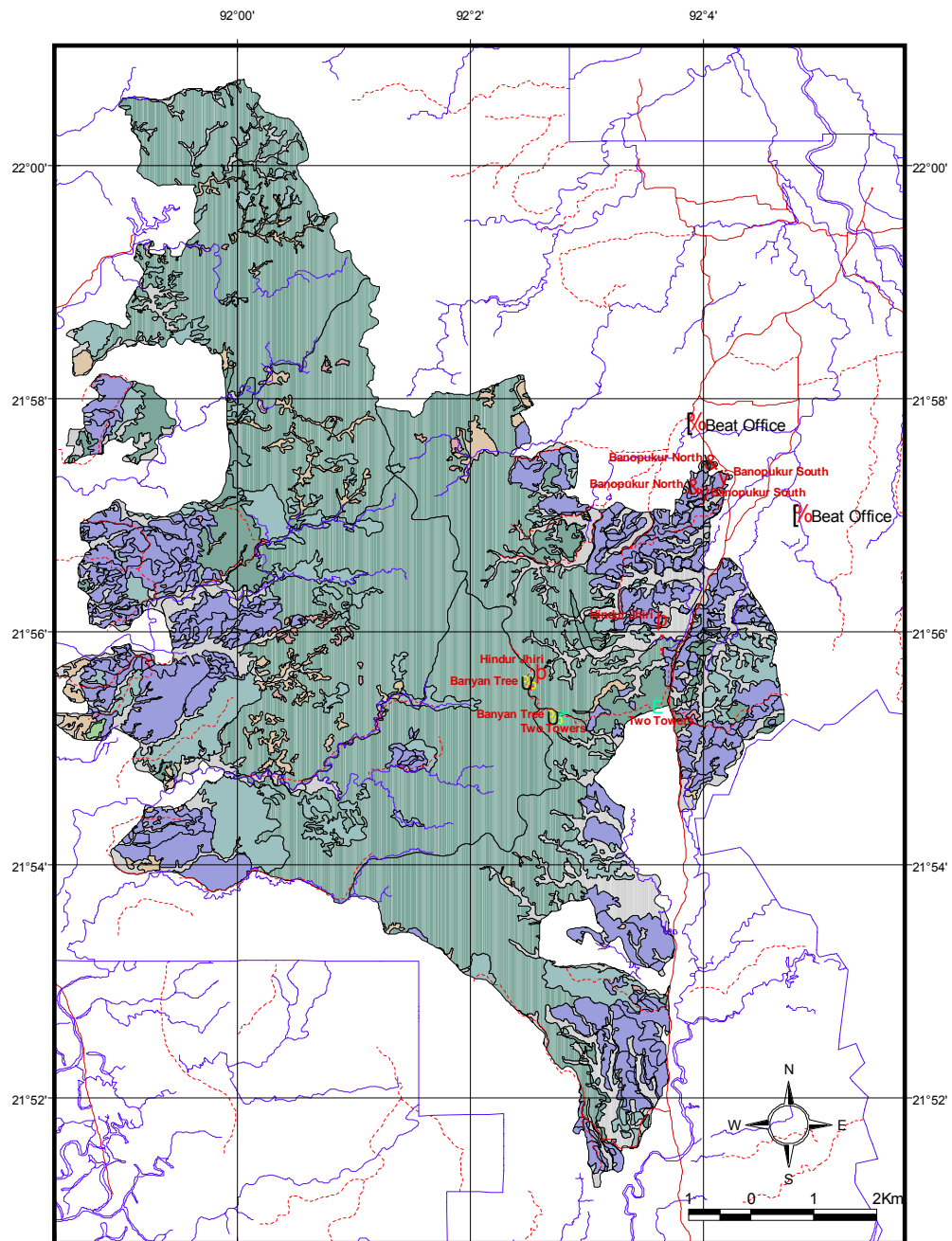


Figure 5. Chunati Wildlife Sanctuary showing the starting and ending points of bird survey transects

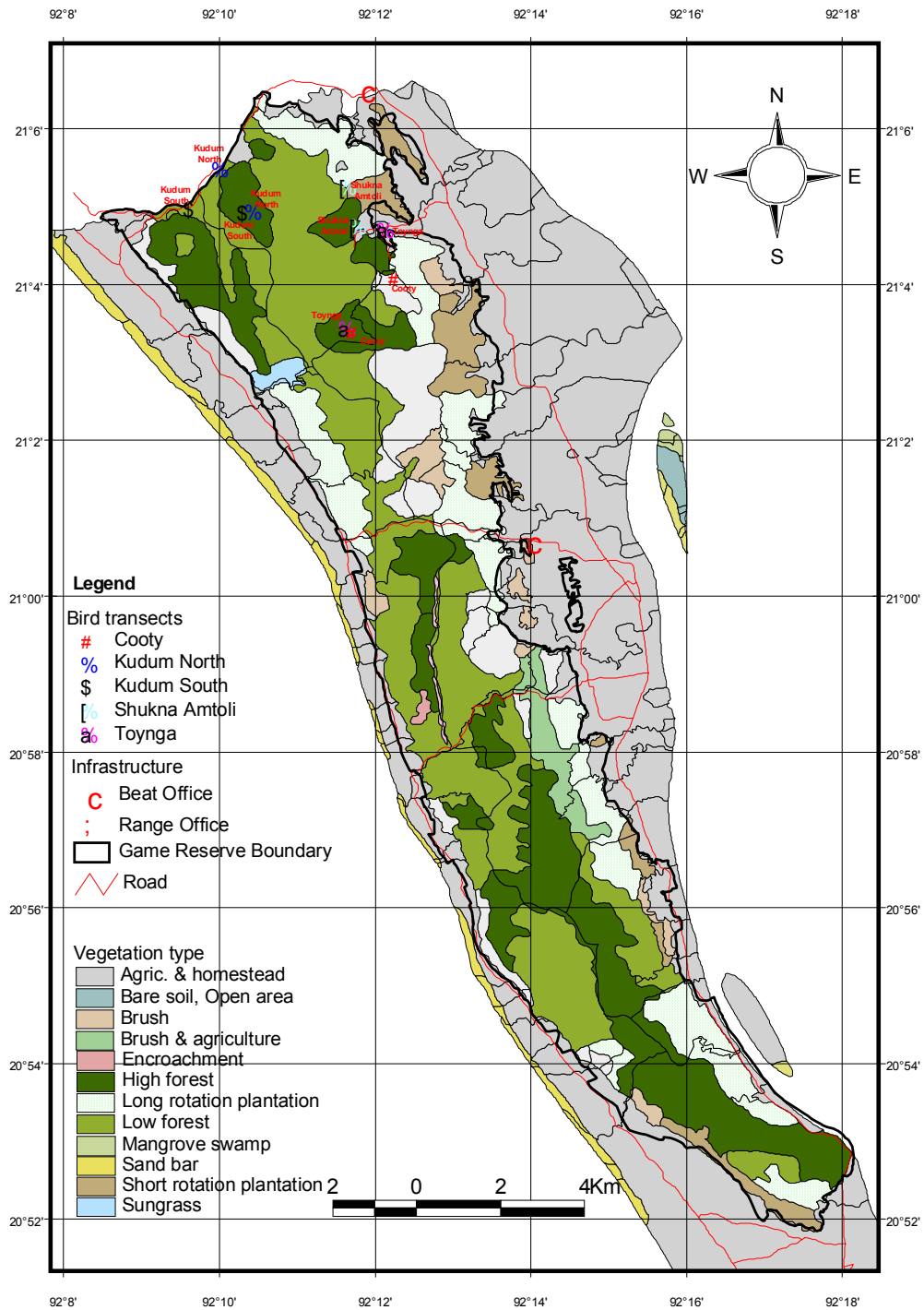


Figure 6. Teknaf Game Reserve showing the starting and ending points of bird survey transects

Chapter 4
RESULTS AND DISCUSSION

4. RESULTS AND DISCUSSION

The survey was conducted during a five-month period (March-July 2006), with about 30 observation-days in the field (at least two visits in each of the five NSP sites). The main outcomes of this survey are the estimates of population density of eight indicator species of birds in the second year (2006), during their breeding season, new additions of bird names in the previous year's (2005) list of all birds, and the comparison of this year's findings with the previous year's findings that tells us the trend of management impacts in five NSP sites. Since all the indicator birds are primarily forest birds, which live in different strata of the forest, and are more sensitive than others, the change of their densities over time was taken as the basis to assess the level of management impacts. Any increment or decrement of the densities of the indicator bird population is an indication whether the condition of the forest has been improved or degraded. However, the surveys must be conducted in the coming years in order to understand the population trend more confidently, over a longer period of time. The surveys should always be conducted at the same season, i.e. the breeding season of birds (February-July), because the densities of indicator birds and overall species diversity will vary in different seasons due to migration and other factors like seasonal availability of food and detectability.

The list of all bird species (including their relative abundance), particularly the forest birds, tells about the richness of the area in terms of biodiversity. It is more likely that the list will gradually increase, because repeated surveys will discover new birds that will be added in the list, but any increment or decrement on the proportions of primarily forest birds in comparison to the total number of birds will indicate whether forest condition has been improved or degraded. However, if the decline of overall avian species richness is ever recorded, it will strongly indicate the degradation of overall biodiversity richness of the area.

4.1 Population Densities of Eight Indicator Bird Species

Like the previous year (2005), the population density, i.e. the number of individuals per square kilometer, was estimated in this year (2006) for each of the eight indicator bird species in each of the five NSP sites (Figure 7a-e). Since these are primarily forest birds, any change in the condition of the forest has an impact on their population densities. This is evident even in five NSP sites if we compare the respective densities with the conditions of five NSP sites. In the field it was observed that Chunati is the poorest among five sites, with very few trees, hence two of the eight indicator species (Oriental Pied Hornbill and Red-headed Trogon) were not recorded there, and the densities of three (Greater Racket-tailed Drongo, Hill Myna and Puff-throated Babbler) of the rest six species were the lowest (Figure 8). However, like in the last year, the density of the Red Junglefowl was the highest in Chunati, and this was the only site where White-crested Laughingthrush was recorded. Another evidence of the strong correlation between the forest condition and the density of these eight species has found in three sites (Lawachara, Satchori and Rema-Kalenga) of the northeast. The ecosystems and forest conditions are very similar in these three sites. Hence, there is a similarity in the density of all the indicator species, despite the fact that the total areas are variable (Figure 8).

This year's density estimates of eight indicator birds in each of the five NSP sites were compared with the last year's estimates, which revealed that two of the indicator birds (Red Junglefowl and Puff-throated Babbler), that live in the understory of the forest, have been increased over the last year (Figure 7a-e). This indicates that the forest understory has started regenerating, which caused the increment of the carrying capacity and nesting sites for these two species. The community patrolling, awareness and other programs by NSP played the key role in reducing the clearing of understory vegetation for firewood.

The increase of the density of these two birds, however, should not be treated as the overall improvement of the forest condition, because the forest (particularly the

tree cover) requires a long time to complete the regeneration process. Ecologically, any regeneration process is very complex and dynamic, involving many natural and anthropogenic factors. Hence, the improved protection to the forest must continue. Moreover, the illegal logging of timber trees and conversion of natural forests to monoculture plantations and agricultural fields (particularly in Teknaf and Rema-Kalenga) still persists, which probably caused slight decline of the Oriental Pied Hornbill over the last year (Figure 7a-e). This bird lives in the top canopy and hence is severely affected if the large trees are removed from the forest. The population densities of other five indicator birds have remained more or less unchanged over the last year (Figure 7a-e).

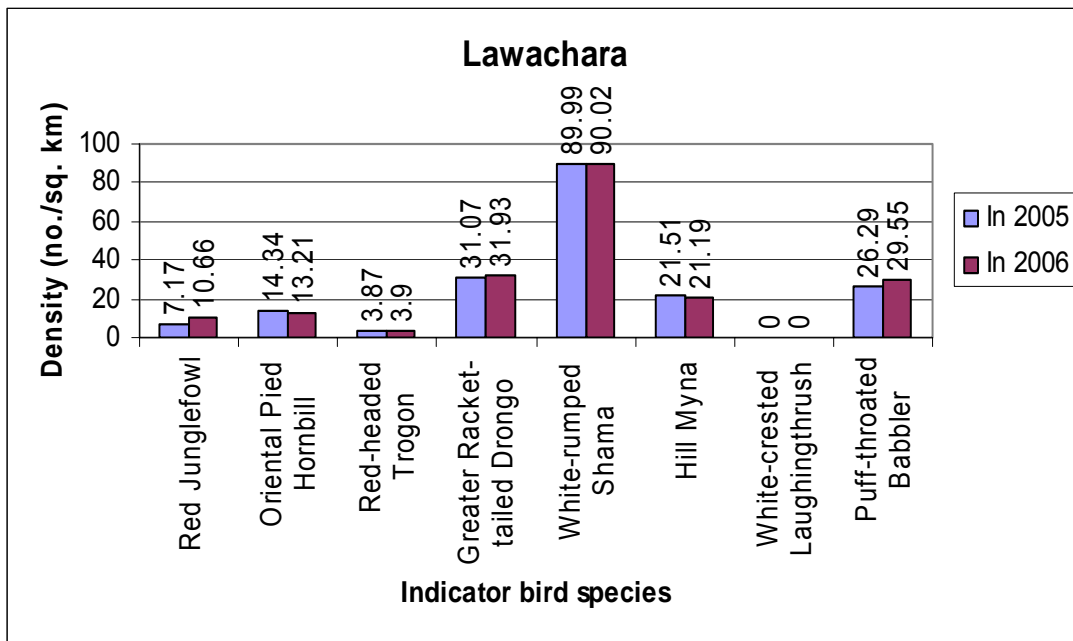


Figure 7a. Population density (no./sq. km) of eight indicator bird species in Lawachara National Park in 2005 and 2006.

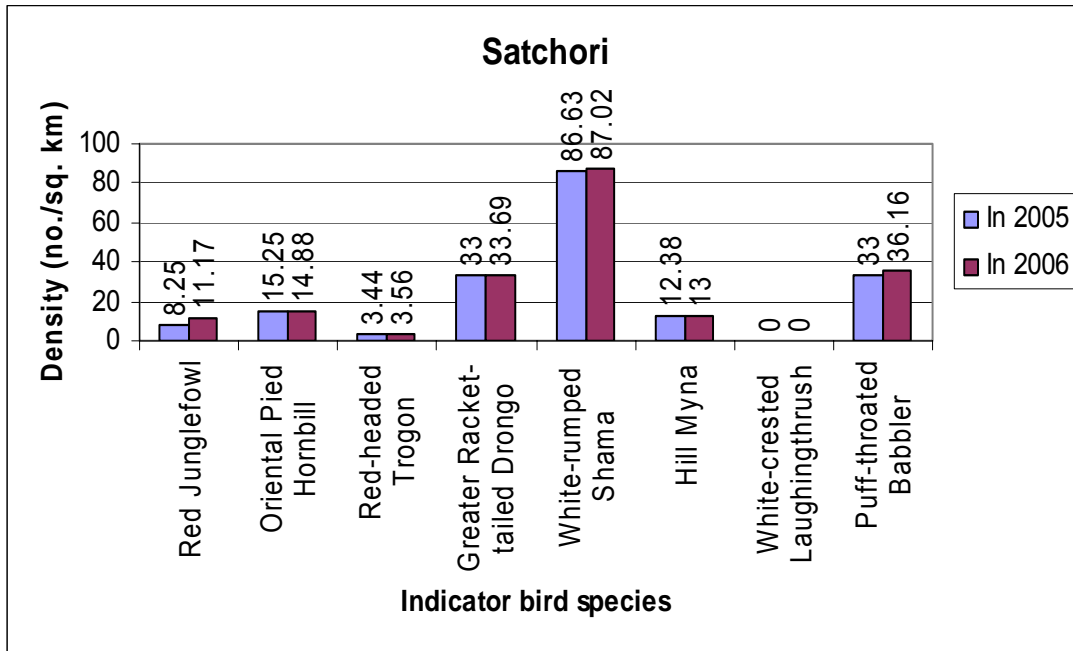


Figure 7b. Population density (no./sq. km) of eight indicator bird species in Satchori National Park in 2005 and 2006.

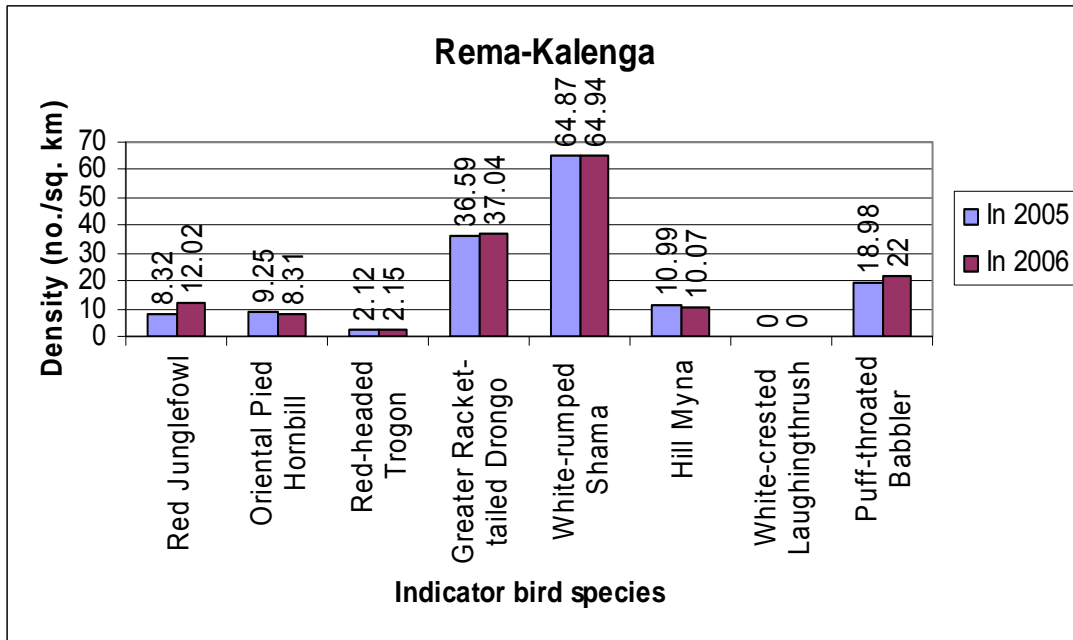


Figure 7c. Population density (no./sq. km) of eight indicator bird species in Rema-Kalenga Wildlife Sanctuary in 2005 and 2006.

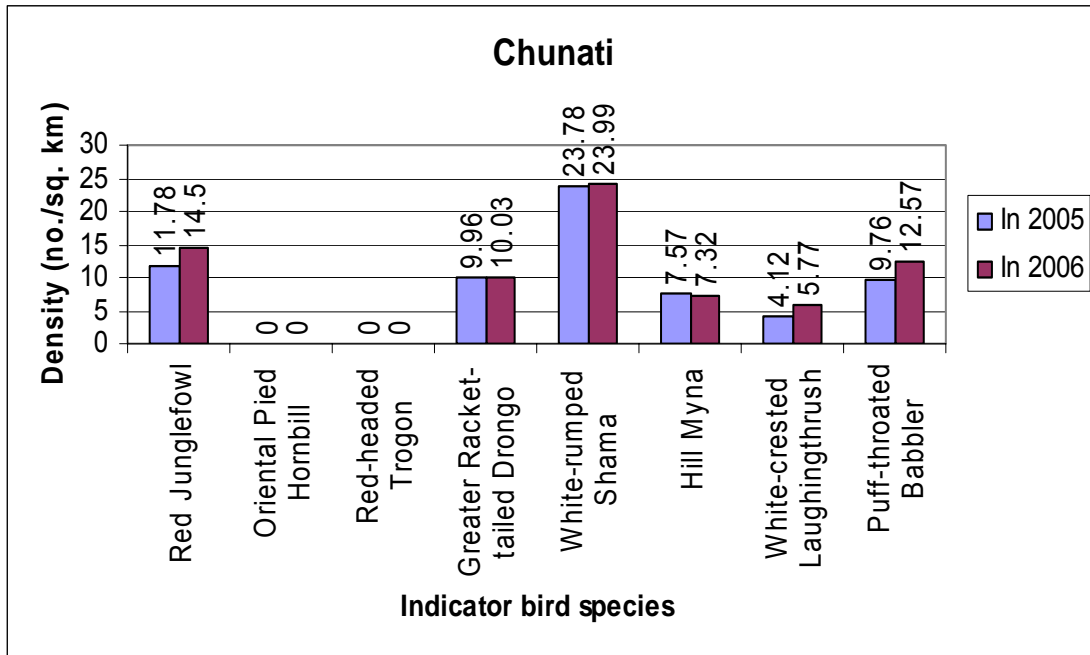


Figure 7d. Population density (no./sq. km) of eight indicator bird species in Chunati Wildlife Sanctuary in 2005 and 2006.

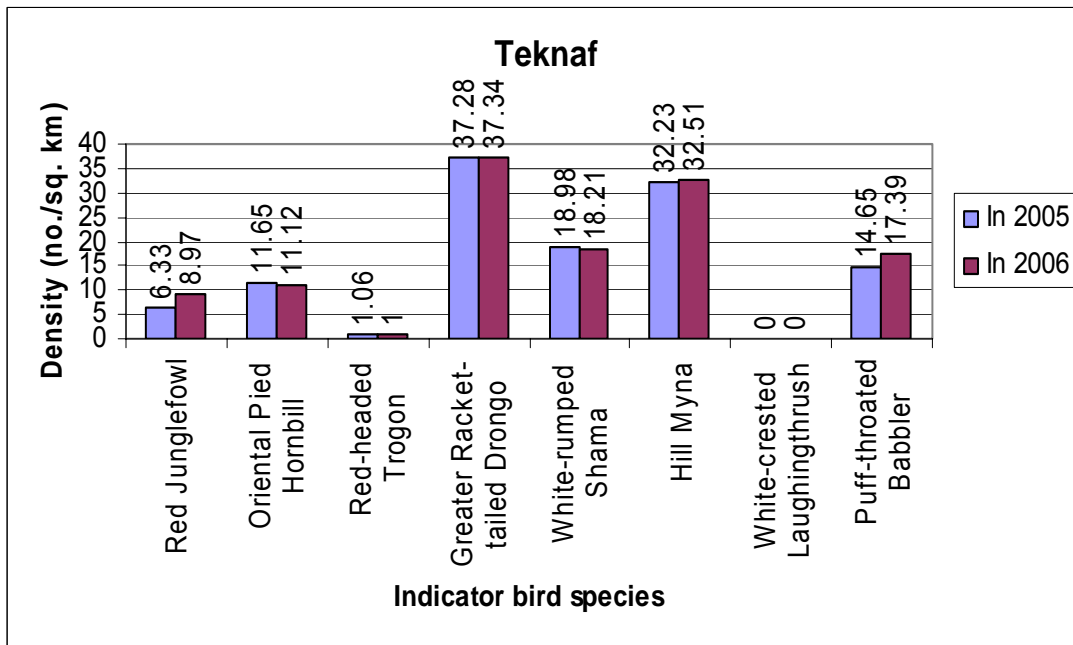


Figure 7e. Population density (no./sq. km) of eight indicator bird species in Teknaf Game Reserve in 2005 and 2006.

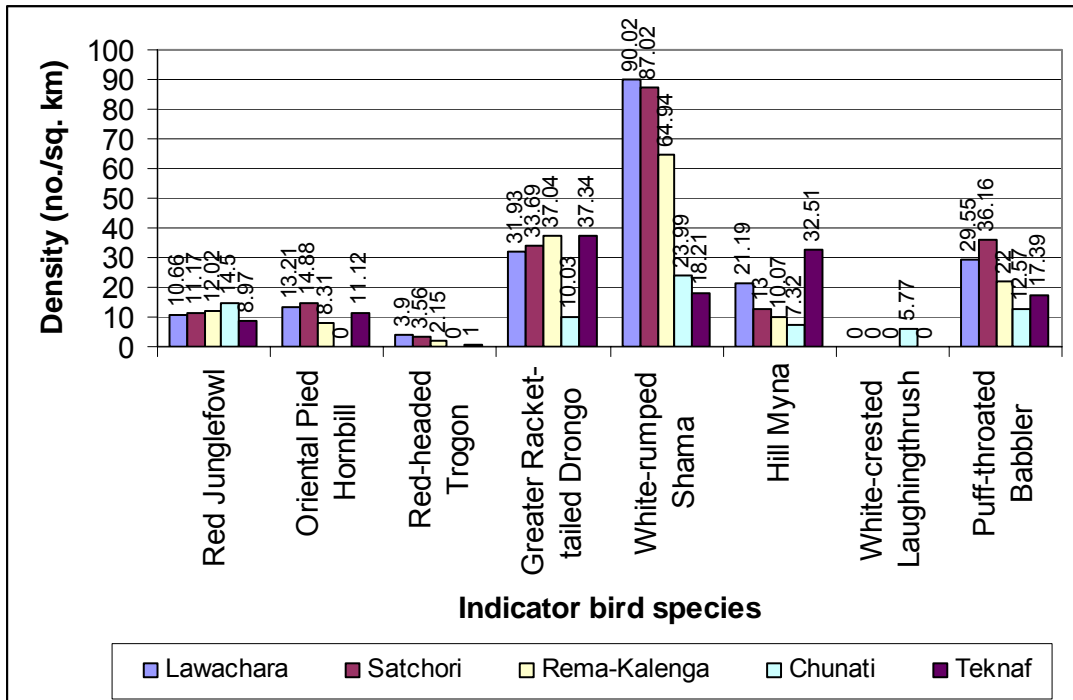


Figure 8. Comparison of the population density of eight indicator bird species across five NSP sites in 2006.

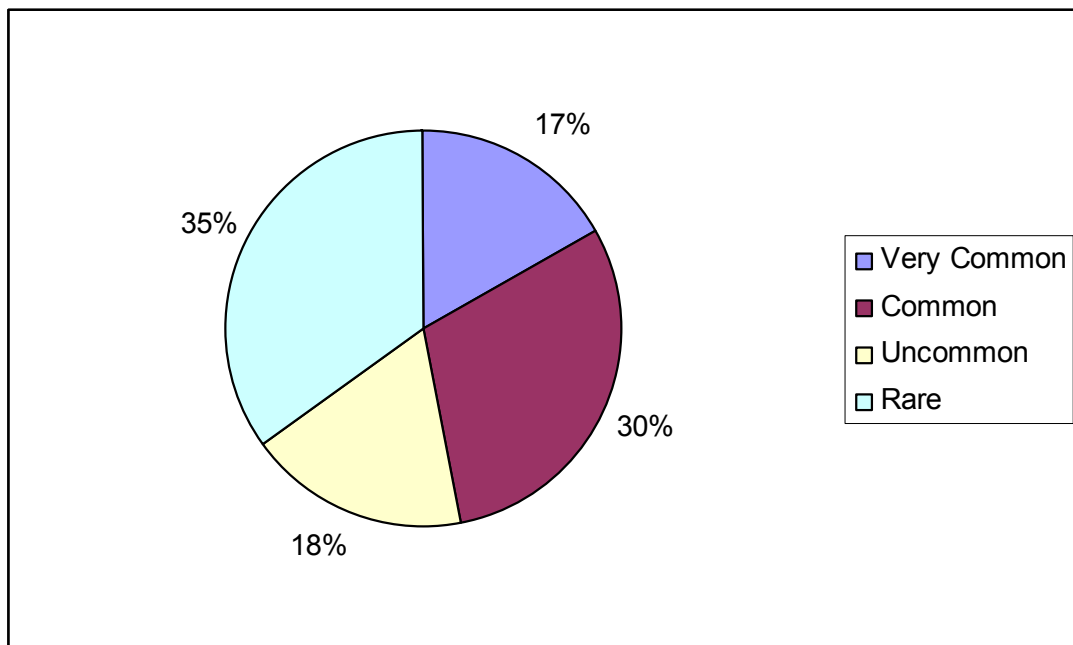


Figure 9. Proportions of Very Common, Common, Uncommon and Rare species of birds in NSP sites in 2006.

4.2 Bird Species Diversity

During the avian breeding season (February-July) of last year (2005) and this year (2006), a total of 219 species of birds have been recorded in five NSP sites, of which 184 (84%) were resident and the rest 35 (16%) migrant (Table 5). Among the resident birds, a total of 7 species are known to migrate locally. Out of 219 species, 37 were Very Common, 65 Common, 40 Uncommon and 77 Rare (Figure 9). The proportion of Rare birds has increased in this year (35%) compared to the last year (31%).

The total bird species (219) recorded in five NSP sites in a limited period of time represents over 30% of the birds recorded in Bangladesh (Harvey 1990, IUCN-Bangladesh 2000), and almost 3% recorded in the Indian Subcontinent (Grewal *et al.* 2002). A relatively high ratio of rare birds (35%) emphasizes the need of continuous monitoring of birds and the immediate need of improving the ecological condition of these areas. Similar studies in other areas of the country (Khan *et al.* 1998, Islam *et al.* 1999, Khan and Islam 2000, Das *et al.* 2000, Khan 2005) strengthened the knowledge of bird species diversity and highlighted that a significant proportion of birds are now rare in different parts of the country.

Among 219 species of birds, the total number of species and the total number of primarily forest species were different in five different sites (Figure 10). Strong correlation ($r = 0.888185$) was found between the total number of bird species and the total number of primarily forest bird species across five NSP sites. No significant difference was found in the proportions of the number of species of primarily forest birds in relation to the total birds in the last year and in this year.

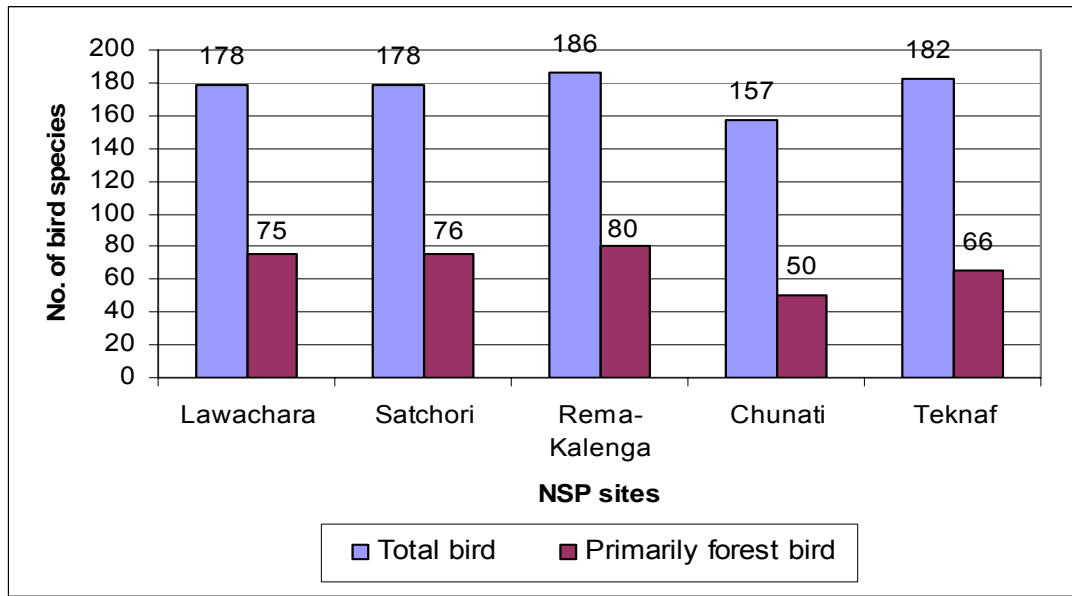


Figure 10. A comparison of the total number of bird species and total number of primarily forest bird species across five NSP sites in 2006.

Table 5. List of birds recorded in five NSP sites (Lawachara, Satchori, Rema-Kalenga, Chunati and Teknaf) that can be found during the main breeding season (February-July) of birds [N.B. The classification followed Inskipp *et al.* (1996)]

Abbreviations: vc – Very Common, c – Common, uc – Uncommon, and r – Rare (in NSP sites); R – Resident, M – Migrant, Rm – Resident but local migration often recorded; L – Lawachara National Park, S – Satchori National Park, RK – Rema-Kalenga Wildlife Sanctuary, C – Chunati Wildlife Sanctuary, T – Teknaf Game Reserve, and W – Wide (all NSP sites).

Sl. No.	English Name	Scientific Name	Relative abundance, Resident/ Migrant	Distribution
ORDER: GALLIFORMES				
Family: Phasianidae				
1	Common Quail	<i>Coturnix coturnix</i>	r, M	L, S, RK, C
2	White-cheeked Partridge*	<i>Arborophila atrogularis</i>	r, R	L, S, RK
3	Red Junglefowl*	<i>Gallus gallus</i>	c, R	W
4	Kalij Pheasant*	<i>Lophura leucomelanos</i>	uc, R	W
5	Green Peafowl*	<i>Pavo muticus</i>	r, R	T? One local report of trapping in early 2004
6	Grey Peacock Pheasant*	<i>Polyplectron bicalcaratum</i>	r, R	T, RK?

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ORDER: ANSERIFORMES				
Family: Dendrocygnidae				
7	Lesser Whistling-duck	<i>Dendrocygna javanica</i>	c, R	T, RK
Family: Anatidae				
8	Cotton Pygmy-goose	<i>Nettapus coromandelianus</i>	r, R	T
ORDER: PICIFORMES				
Family: Picidae				
9	Eurasian Wryneck	<i>Jynx torquilla</i>	uc, M	W
10	Rufous Woodpecker	<i>Celeus brachyurus</i>	c, R	W
11	Great Slaty Woodpecker*	<i>Mulleripicus pulverulentus</i>	r, R	T
12	Grey-capped Pygmy Woodpecker*	<i>Dendrocopos canicapillus</i>	r, R	W
13	Fulvous-breasted Woodpecker	<i>Dendrocopos macei</i>	vc, R	W
14	Greater Yellownappe*	<i>Picus flavinucha</i>	c, R	W
15	Streak-throated Woodpecker	<i>Picus xanthopygaeus</i>	r, R	L, S, RK
16	Grey-headed Woodpecker Ψ	<i>Picus canus</i>	r, R	L, S
17	Black-rumped Flameback	<i>Dinopium benghalense</i>	vc, R	W
18	Greater Flameback*	<i>Chrysocolaptes lucidus</i>	vc, R	W
Family: Megalaimidae				
19	Lineated Barbet	<i>Megalaima lineata</i>	vc, R	W
20	Blue-throated Barbet	<i>Megalaima asiatica</i>	vc, R	W
21	Blue-eared Barbet* Ψ	<i>Megalaima australis</i>	uc, R	L, S, RK, T
22	Coppersmith barbet	<i>Megalaima haemacephala</i>	vc, R	W
ORDER: BUCEROTIFORMES				
Family: Bucerotidae				
23	Oriental Pied Hornbill*	<i>Anthraceros albirostris</i>	uc, R	L, S, RK, T
ORDER: UPUPIFORMES				
Family: Upupidae				
24	Common Hoopoe	<i>Upupa epops</i>	c, R	W
ORDER: TROGONIFORMES				
Family: Trogonidae				
25	Red-headed Trogon*	<i>Harpactes erythrocephalus</i>	r, R	L, S, RK, T
ORDER: CORACIIFORMES				
Family: Coraciidae				
26	Indian Roller	<i>Coracias benghalensis</i>	vc, R	W
27	Dollarbird*	<i>Eurystomus orientalis</i>	r, R	W
Family: Alcedinidae				
28	Common Kingfisher	<i>Alcedo atthis</i>	c, R	W
Family: Halcyonidae				
29	White-throated Kingfisher	<i>Halcyon smyrnensis</i>	c, R	W
Family: Cerylidae				
30	Pied Kingfisher	<i>Ceryle rudis</i>	r, R	T
Family: Meropidae				
31	Blue-bearded Bee-eater*	<i>Nyctyornis athertoni</i>	r, R	W
32	Green Bee-eater	<i>Merops orientalis</i>	vc, R	W
33	Blue-tailed Bee-eater*	<i>Merops philippinus</i>	c, R	W
34	Chestnut-headed Bee-eater*	<i>Merops leschenaulti</i>	vc, R	W
ORDER: CUCULIFORMES				
Family: Cuculidae				
35	Pied Cuckoo	<i>Clamator jacobinus</i>	r, Rm	W
36	Common Hawk Cuckoo	<i>Hierococyx varius</i>	vc, R	W
37	Indian Cuckoo	<i>Cuculus micropterus</i>	c, Rm	W

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38	Plaintive Cuckoo	<i>Cacomantis merulinus</i>	c, Rm	W
	Violet Cuckoo* Ψ	<i>Chrysococcyx xanthorhynchus</i>	r, R	S
39	Drongo Cuckoo*	<i>Surniculus lugubris</i>	r, Rm	L, S, RK
40	Asian Koel	<i>Eudynamys scolopacea</i>	vc, R	W
41	Green-billed Malkoha*	<i>Phaenicophaeus tristis</i>	vc, R	W
Family: Centropodidae				
42	Greater Coucal	<i>Centropus sinensis</i>	vc, R	W
43	Lesser Coucal*	<i>Centropus bengalensis</i>	c, R	W
ORDER: PSITTACIFORMES				
Family: Psittacidae				
44	Vernal Hanging Parrot*	<i>Loriculus vernalis</i>	r, R	L, S, RK, T
45	Rose-ringed Parakeet	<i>Psittacula krameri</i>	vc, R	W
46	Grey-headed Parakeet*	<i>Psittacula finschii</i>	r, R	L, S, RK
47	Blossom-headed Parakeet*	<i>Psittacula roseata</i>	r, R	L, S, RK
48	Red-breasted Parakeet*	<i>Psittacula alexandri</i>	vc, R	W
ORDER: APODIFORMES				
Family: Apodidae				
49	Asian Palm Swift	<i>Cypsiurus balasensis</i>	c, R	W
50	Fork-tailed Swift* Ψ	<i>Apus pacificus</i>	r, M	T
ORDER: STRIGIFORMES				
Family: Strigidae				
51	Oriental Scops Owl*	<i>Otus sunia</i>	r, R	L, S, RK
52	Collared Scops Owl Ψ	<i>Otus bakkamoena</i>	r, R	W
53	Brown Fish Owl	<i>Ketupa zeylonensis</i>	r, R	W
54	Tawny Fish Owl*	<i>Ketupa flavipes</i>	r, R	RK, T
55	Asian Barred Owlet*	<i>Glaucidium cuculoides</i>	c, R	W
56	Spotted Owlet	<i>Athene brama</i>	vc, R	W
57	Brown Hawk Owl	<i>Ninox scutulata</i>	c, R	W
Family: Caprimulgidae				
58	Large-tailed nightjar*	<i>Caprimulgus macrurus</i>	c, R	W
ORDER: COLUMBIFORMES				
Family: Columbidae				
59	Rock Pigeon	<i>Columba livia</i>	c, R	W
60	Green Imperial Pigeon*	<i>Ducula aenea</i>	r, R	L, S, RK
61	Oriental Turtle Dove*	<i>Streptopelia orientalis</i>	r, Rm	L, S, RK
62	Spotted Dove	<i>Streptopelia chinensis</i>	vc, R	W
63	Red Collared Dove	<i>Streptopelia tranquebarica</i>	c, R	W
64	Eurasian Collared Dove	<i>Streptopelia decaocto</i>	c, R	W
65	Barred Cuckoo Dove* Ψ	<i>Macropygia unchall</i>	r, R	S
66	Emerald Dove*	<i>Chalcophaps indica</i>	c, R	W
67	Orange-breasted Green Pigeon*	<i>Treron bicincta</i>	r, R	L, S, RK
68	Pompadour Green Pigeon*	<i>Treron pompadora</i>	c, R	W
69	Thick-billed Green Pigeon*	<i>Treron curvirostra</i>	r, R	L, S, RK
70	Yellow-footed Green Pigeon	<i>Treron phoenicoptera</i>	c, R	W
71	Wedge-tailed Green Pigeon*	<i>Treron sphenura</i>	r, R	L, S, RK
ORDER: GRUIFORMES				
Family: Rallidae				
72	White-breasted Waterhen	<i>Amauornis phoenicurus</i>	uc, R	W
ORDER: CICONIIFORMES				
Family: Scolopacidae				
73	Pintail Snipe	<i>Gallinago stenura</i>	r, M	W

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74	Common Snipe	<i>Gallinago gallinago</i>	r, M	W
75	Green Sandpiper	<i>Tringa ochropus</i>	r, M	W
76	Wood Sandpiper	<i>Tringa glareola</i>	c, M	W
77	Common Sandpiper	<i>Actitis hypoleucos</i>	c, M	W
Family: Rostratulidae				
78	Greater Painted Snipe	<i>Rostratula benghalensis</i>	uc, R	W
Family: Jacanidae				
79	Bronze-winged Jacana	<i>Metopidius indicus</i>	uc, R	W
Family: Charadriidae				
80	Little Ringed Plover	<i>Charadrius dubius</i>	r, M	RK, C, T
81	Red-wattled Lapwing	<i>Vanellus indicus</i>	uc, R	W
Family: Glareolidae				
82	Small Pratincole Ψ	<i>Glareola lactea</i>	r, R	T
Family: Laridae				
83	River Tern Ψ	<i>Sterna aurantia</i>	uc, R	T
84	Little Tern Ψ	<i>Sterna albifrons</i>	uc, R	T
Family: Accipitridae				
85	Osprey Ψ	<i>Pandion haliaetus</i>	r, M	T
86	Black Baza*	<i>Aviceda leuphotes</i>	uc, Rm	L, S, RK, T
87	Black-shouldered Kite	<i>Elanus caeruleus</i>	uc, R	W
88	Black Kite	<i>Milvus migrans</i>	uc, R	W
89	Brahminy Kite	<i>Haliastur indus</i>	c, R	W
90	White-rumped Vulture	<i>Gyps bengalensis</i>	uc, R	RK, C, T
91	Crested Serpent Eagle*	<i>Spilornis cheela</i>	c, R	W
92	Shikra*	<i>Accipiter badius</i>	uc, R	W
93	Changeable Hawk Eagle*	<i>Spizaetus cirrhatous</i>	r, R	L, S, RK
Family: Falconidae				
94	Common Kestrel*	<i>Falco tinnunculus</i>	uc, M	W
95	Amur Falcon*	<i>Falco amurensis</i>	r, M	L
Family: Phalacrocoracidae				
96	Little Cormorant	<i>Phalacrocorax niger</i>	r, R	T
Family: Ardeidae				
97	Little Egret	<i>Egretta garzetta</i>	uc, R	W
98	Cattle Egret	<i>Bubulcus ibis</i>	uc, R	W
99	Indian Pond Heron	<i>Ardeola grayii</i>	vc, R	W
100	Black-crowned Night Heron	<i>Nycticorax nycticorax</i>	r, R	RK, C, T
101	Yellow Bittern Ψ	<i>Ixobrychus sinensis</i>	r, R	T
102	Cinnamon Bittern	<i>Ixobrychus cinnamomeus</i>	uc, R	RK, C, T
Order: Ciconiidae				
103	Asian Openbill	<i>Anastomus oscitans</i>	r, R	RK
ORDER: PASSERIFORMES				
Family: Pittidae				
104	Blue-naped Pitta* Ψ	<i>Pitta nipalensis</i>	r, R	T
105	Hooded Pitta*	<i>Pitta sordida</i>	r, Rm	L, S, RK
Family: Irenidae				
106	Asian Fairy Bluebird*	<i>Irena puella</i>	c, R	L, S, RK, T
107	Blue-winged Leafbird* Ψ	<i>Chloropsis cochinchinensis</i>	r, R	T
108	Golden-fronted Leafbird	<i>Chloropsis aurifrons</i>	vc, R	W
Family: Laniidae				
109	Brown Shrike	<i>Lanius cristatus</i>	c, M	W
110	Long-tailed Shrike	<i>Lanius schach</i>	c, R	W
Family: Corvidae				
111	Common Green Magpie*	<i>Cissa chinensis</i>	r, R	S, T

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112	Rufous Treepie	<i>Dendrocitta vagabunda</i>	c, R	W
113	Grey Treepie* Ψ	<i>Dendrocitta formosae</i>	uc, R	W
114	House Crow	<i>Corvus splendens</i>	uc, R	C, T
115	Large-billed Crow	<i>Corvus macrorhynchos</i>	uc, R	W
116	Ashy Woodswallow	<i>Artamus fuscus</i>	uc, R	W
117	Black-naped Oriole* Ψ	<i>Oriolus chinensis</i>	r, M	RK
118	Black-hooded Oriole	<i>Oriolus xanthornus</i>	vc, R	W
119	Maroon Oriole*	<i>Oriolus traillii</i>	r, R	L
120	Large Cuckooshrike	<i>Coracina macei</i>	c, R	W
121	Black-winged Cuckooshrike*	<i>Coracina melaschistos</i>	r, M	L, S, RK
122	Black-headed Cuckooshrike Ψ	<i>Coracina melanoptera</i>	r, R	W
123	Rosy Minivet*	<i>Pericrocotus roseus</i>	r, R	L, S, RK
124	Ashy Minivet*	<i>Pericrocotus divaricatus</i>	r, R	L, S, RK
125	Small Minivet*	<i>Pericrocotus cinnamomeus</i>	vc, R	W
126	Scarlet Minivet*	<i>Pericrocotus flammeus</i>	c, R	W
127	Bar-winged Flycatcher-shrike*	<i>Hemipus picatus</i>	uc, R	L, S, RK
128	White-throated Fantail	<i>Rhipidura albicollis</i>	c, R	W
129	Black Drongo	<i>Dicrurus macrocercus</i>	vc, R	W
130	Ashy Drongo	<i>Dicrurus leucophaeus</i>	r, M	W
131	Bronzed Drongo*	<i>Dicrurus aeneus</i>	vc, R	W
132	Lesser Racket-tailed Drongo*	<i>Dicrurus remifer</i>	r, M	L, S, RK
133	Spangled Drongo*	<i>Dicrurus hottentottus</i>	c, R	W
134	Greater Racket-tailed Drongo*	<i>Dicrurus paradiseus</i>	c, R	W
135	Black-naped Monarch	<i>Hypothymis azurea</i>	c, R	W
136	Common Iora	<i>Aegithina tiphia</i>	vc, R	W
137	Large Woodshrike*	<i>Tephrodornis gularis</i>	c, R	L, S, RK
138	Common Woodshrike*	<i>Tephrodornis pondicerianus</i>	c, R	W
Family: Muscicapidae				
139	Blue Rock Thrush	<i>Monticola solitarius</i>	uc, M	W
140	Blue Whistling Thrush*	<i>Myophonus caeruleus</i>	r, R	T
141	Orange-headed Thrush	<i>Zoothera citrina</i>	r, R	W
142	Red-throated Flycatcher	<i>Ficedula parva</i>	vc, M	W
143	Verditer Flycatcher*	<i>Eumyias thalassina</i>	uc, M	W
144	Pale-chinned Flycatcher*	<i>Cyornis polioagenys</i>	r, R	RK
145	Grey-headed Canary Flycatcher	<i>Culicicapa ceylonensis</i>	c, R	W
146	Oriental Magpie Robin	<i>Copsychus saularis</i>	vc, R	W
147	White-rumped Shama*	<i>Copsychus malabaricus</i>	c, R	W
148	Black Redstart	<i>Phoenicurus ochruros</i>	r, M	W
149	Black-backed Forktail*	<i>Enicurus immaculatus</i>	r, R	L, S, RK, T
150	Slaty-backed Forktail*	<i>Enicurus schistaceus</i>	r, R	L, S, RK
151	Common Stonechat	<i>Saxicola torquata</i>	c, M	W
152	Pied Bushchat	<i>Saxicola caprata</i>	r, R	C, T
Family: Sturnidae				
153	Asian Glossy Starling Ψ	<i>Aplonis panayensis</i>	r, M	T
154	Chestnut-tailed Starling	<i>Sturnus malabaricus</i>	vc, R	W
155	Asian Pied Starling	<i>Sturnus contra</i>	vc, R	W
156	Common Myna	<i>Acridotheres tristis</i>	vc, R	W
157	Bank Myna	<i>Acridotheres ginginianus</i>	r, R	W
158	Jungle Myna	<i>Acridotheres fuscus</i>	vc, R	W
159	Hill Myna*	<i>Gracula religiosa</i>	c, R	W
Family: Sittidae				
160	Velvet-fronted Nuthatch*	<i>Sitta frontalis</i>	r, R	RK

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Family: Paridae				
161	Great Tit	<i>Parus major</i>	vc, R	W
Family: Hirundinidae				
162	Barn Swallow	<i>Hirundo rustica</i>	c, M	W
Family: Pycnonotidae				
163	Black-headed Bulbul*	<i>Pycnonotus atriceps</i>	uc, R	W
164	Black-crested Bulbul*	<i>Pycnonotus melanicterus</i>	c, R	W
165	Red-whiskered Bulbul	<i>Pycnonotus jocosus</i>	vc, R	W
166	Red-vented Bulbul	<i>Pycnonotus cafer</i>	vc, R	W
167	White-throated Bulbul*	<i>Alophoixus flaveolus</i>	c, R	W
168	Olive Bulbul*	<i>Lole virescens</i>	r, R	RK
Family: Cisticolidae				
169	Grey-breasted Prinia	<i>Prinia hodgsonii</i>	c, R	W
170	Plain Prinia	<i>Prinia inornata</i>	uc, R	W
171	Zitting Cisticola	<i>Cisticola juncidis</i>	c, R	W
Family: Zosteropidae				
172	Oriental White-eye	<i>Zosterops palpebrosus</i>	vc, R	W
Family: Sylviidae				
173	Blyth's Reed Warbler	<i>Acrocephalus dumetorum</i>	c, M	W
174	Striated Grassbird	<i>Megalurus palustris</i>	uc, R	C, T
175	Mountain Tailorbird*	<i>Orthotomus cuculatus</i>	r, R	T
176	Common Tailorbird	<i>Orthotomus sutorius</i>	vc, R	W
177	Dark-necked Tailorbird*	<i>Orthotomus atrogularis</i>	uc, R	T, C
178	Common Chiffchaff	<i>Phylloscopus collybita</i>	uc, R	W
179	Yellow-browed Warbler* Ψ	<i>Phylloscopus inornatus</i>	c, M	W
180	Greenish Warbler*	<i>Phylloscopus trochiloides</i>	c, M	W
181	Blyth's Leaf Warbler	<i>Phylloscopus reguloides</i>	uc, M	L, S, RK
182	White-crested Laughingthrush*	<i>Garrulax leucolophus</i>	r, R	C
183	Greater Necklaced Laughingthrush*	<i>Garrulax pectoralis</i>	c, R	W
184	Rufous-necked Laughingthrush*	<i>Garrulax ruficollis</i>	uc, R	W
185	Abbott's Babbler*	<i>Malacocincla abbotti</i>	c, R	W
186	Spot-throated Babbler*	<i>Pellorneum albiventre</i>	r, R	L
187	Puff-throated Babbler*	<i>Pellorneum ruficeps</i>	c, R	W
188	Large Scimitar Babbler*	<i>Pomatorhinus hypoleucos</i>	r, R	T
189	White-browed Scimitar Babbler*	<i>Pomatorhinus schisticeps</i>	r, R	L, S, RK
190	Grey-throated Babbler* Ψ	<i>Stachyris nigriceps</i>	r, R	C
191	Striped Tit Babbler*	<i>Macronous gularis</i>	c, R	W
192	Chestnut-capped Babbler*	<i>Timalia pileata</i>	r, R	C
Family: Alaudidae				
193	Indian Bushlark	<i>Mirafra erythroptera</i>	r, R	C, T
194	Rufous-winged Bushlark	<i>Mirafra assamica</i>	c, R	W
Family: Nectariniidae				
195	Thick-billed Flowerpecker	<i>Dicaeum agile</i>	uc, R	W
196	Orange-bellied Flowerpecker*	<i>Dicaeum trigonostigma</i>	r, R	T
197	Pale-billed Flowerpecker	<i>Dicaeum erythrorhynchos</i>	c, R	W
198	Scarlet-backed Flowerpecker*	<i>Dicaeum cruentatum</i>	c, R	W
199	Ruby-cheeked Sunbird*	<i>Anthreptes singalensis</i>	uc, R	W
200	Purple-rumped Sunbird	<i>Nectarinia zeylonica</i>	uc, R	W
201	Purple-throated Sunbird*	<i>Nectarinia sperata</i>	c, R	W
202	Purple Sunbird	<i>Nectarinia asiatica</i>	vc, R	W
203	Crimson Sunbird*	<i>Aethopyga siparaja</i>	c, R	W

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204	Little Spiderhunter*	<i>Arachnothera longirostra</i>	vc, R	W
Family: Passeridae				
205	House Sparrow	<i>Passer domesticus</i>	c, R	W
206	Forest Wagtail*	<i>Dendronanthus indicus</i>	uc, M	W
207	White Wagtail	<i>Motacilla alba</i>	c, M	W
208	White-browed Wagtail	<i>Motacilla maderaspatensis</i>	c, R	W
209	Citrine Wagtail	<i>Motacilla citreola</i>	r, M	W
210	Yellow Wagtail	<i>Motacilla flava</i>	uc, M	W
211	Grey Wagtail	<i>Motacilla cinerea</i>	uc, M	W
212	Paddyfield Pipit	<i>Anthus ruficollis</i>	c, R	W
213	Olive-backed Pipit*	<i>Anthus hodgsoni</i>	c, M	W
214	Red-throated Pipit	<i>Anthus cervinus</i>	r, M	RK
215	Baya Weaver	<i>Ploceus philippinus</i>	c, R	W
216	Indian Silverbill	<i>Lonchura malabarica</i>	r, R	W
217	White-rumped Munia	<i>Lonchura striata</i>	uc, R	W
218	Scaly-breasted Munia	<i>Lonchura punctulata</i>	c, R	W
219	Black-headed Munia	<i>Lonchura malacca</i>	r, R	W

* Primarily forest species.

Ψ Recorded in the second year's survey (2006).

4.3 Important Observations in the Field

The important or rare birds observed during this year's (2006) survey are Common Quail, White-cheeked Partridge, Kalij Pheasant, Blue-eared Barbet, Red-headed Trogon, Blue-bearded Bee-eater, Violet Cuckoo, Drongo Cuckoo, Blossom-headed Parakeet, Fork-tailed Swift, Collared Scops Owl, Oriental Turtle Dove, Barred Cuckoo Dove, Wedge-tailed Green Pigeon, Greater Painted Snipe, Small Pratincole, Osprey, Black Baza, Changeable Hawk Eagle, Yellow Bittern, Blue-naped Pitta, Blue-winged Leafbird, Common Green Magpie, Black-naped Oriole, Asian Glossy Starling, Olive Bulbul, White-crested Laughingthrush, Grey-throated Babbler and Chestnut-capped Babbler. There was no, or were very few, sight records of these species in Bangladesh (Khan 1982, Harvey 1990, IUCN-Bangladesh 2000), so the findings will significantly enrich the knowledge on the national status of these birds. Moreover, rare nests were seen, which were of Rufous-necked Laughingthrush, Greater Flameback, Large Woodshrike, White-throated Bulbul and Hill Myna.

Other than the birds, some other important wildlife were observed in the field. These include a number of rare amphibians and reptiles of which two skins are

new for Bangladesh, Fying Lizard (*Draco blanfordii*), Painted Bronzeback Tree Snake (*Dendrelaphis pictus*), Leaf-nose Bat (*Hipposideros* sp.), Malayan Giant Squirrel (*Ratufa bicolor*), Barking Deer (*Muntiacus muntjak*), Slow Loris (*Nycticebus coucang*), Pig-tailed Macaque (*Macaca nemestrina*) and Phayre's Langur (*Trachypithecus phayrei*).

Four rare species of plants were found during the survey, which are *Hedychium coccineum* (found in Rema-Kalenga), 'ulot chondal' (*Gloriosa superba*) (found in Teknaf), a species of *Ixora* with white flowers (found in Teknaf), and 'makal' (*Hodgsonia macrocarpa*) (found in Lawachara). Among these, the first species is one of the least-known plants of Bangladesh (Khan *et al.* 2001).

4.4 Threats to the Birds and Their Habitats

Habitat loss remains as the main threat to the birds in all the five NSP sites. Like in the previous year, illegal felling of trees and bamboo and conversion of natural forests to monoculture plantations and agricultural fields were witnessed during this year's survey. In the Toynga Hill, Teknaf, a large area of the natural forest in hill-slope have been cleared for 'jhum' (shifting) cultivation. Signs of severe logging (some legal, but mostly illegal) of teak and other hardwood trees have been observed in Kalenga Beat, Rema-Kalenga. Only in Lawachara, Satchori and Chunati there was no sign of large-scale deterioration of the wilderness, and to some extent, the wilderness have been improved in these three sites.

Hunting and trapping of birds, mainly by the ethnic tribal people, together with nestling-theft for selling as cage birds, is the second-most severe threat to the birds. People use arrows and bows to hunt Red Junglefowl, Kalij Pheasant, Oriental Pied hornbill and many other large birds and mammals. Some of them have guns to make the hunt more successful. They also use loop-traps for ground birds and glue-traps for small birds. Both tribal and non-tribal 'Bangalis' steal the nestlings of Hill Myna and other colourful birds, and put them into the cage. Some of them commercially collect the nestlings to sale them elsewhere. Locally, a

young Hill Myna is sold by Tk 700-1000 (US \$ 11-16), which is a very high price. This is about one week's subsistence for a small family.

NSP should focus on reducing these two threats, because the rate of loss of tree cover is still very alarming, together with the conversion of lands. If this rate continues, 20-30% of the tree cover in all NSP sites might vanish in the next three years. The local communities should be motivated and alternative livelihood (including ecotourism) should be made available in order to reduce the consumptive use of the forest products. Necessary steps have already been taken by NSP to achieve these, but these have a lot more to implement in the field and expand in a wider scale. The network of poachers and corrupt custodians has to be broken down by making the local young people, conservationists and journalists more aware and vigilant. These forests may remain intact, and even improve, if NSP can stimulate these activities. However, this is a long-term process, so the project should continue for at least ten years, or even more. The participatory bird survey should be repeated on an annual basis, as long as NSP is working in the field, in order to assess the overall trend of the condition of five NSP sites over the long-term.

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APPENDICES

Appendix I. A sample of the data sheet for bird survey, the Bengali version was used in the field

 <p style="font-size: small;">Nishorgo Support Project</p>	<p>Nishorgo Support Project (NSP)</p> <p>Participatory Bird Survey to Assess Protected Area Management Impacts</p>
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Name of the Protected Area:

Name of the Transect:

GPS Coordinates of Two Ends:

Visible Landmarks of Two Ends:

Length of the Transect: km Width of the Transect: km

Date: Time – Start:, End:

Name of Surveyors:

.....

Name of Supervisor(s):

Indicator Bird Species			Total Bird Species (including indicator species) (Tally Count)	Miscellaneous Notes (Any important information on wildlife and nature, recorded at any time while in the field)
Sl. No.	Name	Tally Count		
1	Red Junglefowl			
2	Oriental Pied Hornbill			
3	Red-headed Trogon			
4	Greater Racket-tailed Drongo			
5	White-rumped Shama			
6	Hill Myna			
7	White-crested Laughing-thrush			
8	Puff-throated Babbler			

Appendix II. Names and addresses of the bird survey team members

Team Leader

Dr M. Monirul H. Khan, Lecturer, Department of Zoology, Jahangirnagar University, Savar, Dhaka 1342. E-mail: mmhkhan@hotmail.com. Mobile: 01716-067769.

Participants from Bangladesh Bird Club

- 1) **M. Ahsanul Haq Khokan**, House # 1203 (4th floor), East Manipur, Mirpur, Dhaka. Mobile: 01711-164239.
- 2) **Mustafezur Rahman**, Pearl Daimond, Hotel Sonargaon (ground floor), Dhaka. Mobile: 01711-028380.
- 3) **A.R.K. Reepon**, Bengal Group Ltd., BSEC Bhaban (1st floor), 102 Kazi Nazrul Islam Avenue, Karwan Bazar, Dhaka 1215.
- 4) **Samiul Mohsanin**, Student, Department of Zoology, Jahangirnagar University, Savar, Dhaka 1342. Mobile: 01711-964456.
- 5) **Zahangir Alom**, Student, Department of Zoology, Jahangirnagar University, Savar, Dhaka 1342. Mobile: 01712-287283.

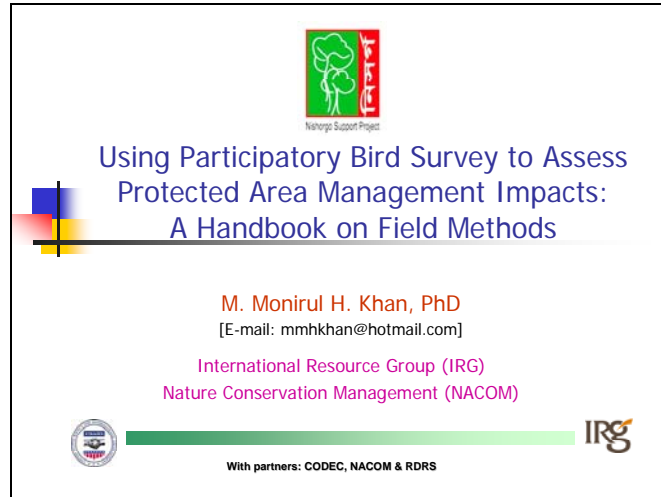
Local Participants

- 1) **Shaymal Dev Burma**, Doluchara, Srimangal, Moulvibazar. Mobile: 01718-009262.
- 2) **M. Rafiqul Islam Khokan**, Kalenga, Chunarughat, Habiganj. Mobile: 01711-921377(on req.)
- 3) **M. Abdur Rahim**, Kalenga, Chunarughat, Habiganj. Mobile: 01718-519157.
- 4) **Shri Vishnu Orang**, Dupbari, Kalenga, Chunarughat, Habiganj.
- 5) **M. Nurul Alam (Sawpon)**, Kalenga, Chunarughat, Habiganj. Mobile: 01711-059574, 0172-920114.
- 6) **Palash Dev Burma**, Satchori, Chunarughat, Habiganj.
- 7) **Russel Dev Burma**, Satchori, Chunarughat, Habiganj.

- 8) **Nazrul Islam**, Deputi Para, Chunati, Lohagara, Chittagong. Mobile: 01713-603989 (on req.).
- 9) **Mohammad Ali**, Green Video, Chunati, Lohagara, Chittagong. Mobile: 01712-079606 (on req.).
- 10) **Sirajul Kader**, Katakhal, Whykeong, Teknaf, Cox's Bazar. Mobile: 0189-673168.
- 11) **Zahangir Alom**, Whykeong, Teknaf, Cox's Bazar. Mobile: 0188-010821, 0189-344515.
- 12) **M. Idris**, Laturikhola, Whykeong, Teknaf, Cox's Bazar. Mobile: 0189-344515.

Appendix III. A sample of the training manual on bird survey (the Bengali version was used in the program)

Slide 1



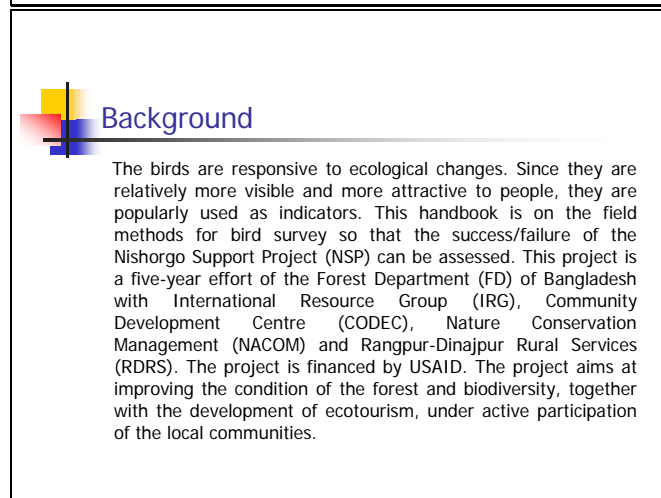
**Using Participatory Bird Survey to Assess Protected Area Management Impacts:
A Handbook on Field Methods**

M. Monirul H. Khan, PhD
[E-mail: mmhkhan@hotmail.com]

International Resource Group (IRG)
Nature Conservation Management (NACOM)

With partners: CODEC, NACOM & RDRS

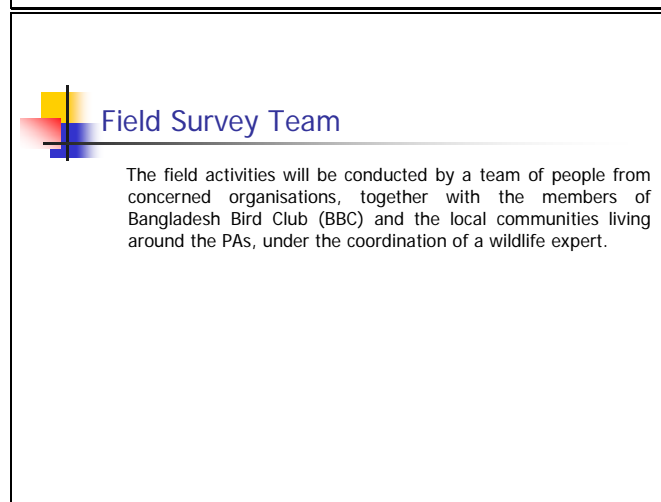
Slide 2



Background

The birds are responsive to ecological changes. Since they are relatively more visible and more attractive to people, they are popularly used as indicators. This handbook is on the field methods for bird survey so that the success/failure of the Nishorgo Support Project (NSP) can be assessed. This project is a five-year effort of the Forest Department (FD) of Bangladesh with International Resource Group (IRG), Community Development Centre (CODEC), Nature Conservation Management (NACOM) and Rangpur-Dinajpur Rural Services (RDRS). The project is financed by USAID. The project aims at improving the condition of the forest and biodiversity, together with the development of ecotourism, under active participation of the local communities.


Slide 3



Field Survey Team

The field activities will be conducted by a team of people from concerned organisations, together with the members of Bangladesh Bird Club (BBC) and the local communities living around the PAs, under the coordination of a wildlife expert.


Slide 4



Aim of the Participatory Bird Survey

- Develop a coordinated approach for the survey of the bird species diversity and population density of several selected bird species to assess impacts of co-management efforts.
- Train the participants of the survey team about the survey method and identification of birds.
- Raise awareness for rare bird species in need of more effective management/conservation efforts.
- Raise awareness of the general public especially PA-level stakeholders to the status of bird species and the importance of conservation.


Slide 5



Methods Considered

Method	Description	Suitability	Decision
Quadrat sampling	Objects are counted from sample quadrats	Suitable for population estimation of less mobile or immobile organisms, e.g. earthworms, plants	Rejected
Strip transect sampling	A combination of quadrat sampling and line transect sampling where objects are counted from straight, long and narrow strips	Suitable for population estimation of visible organisms, no problem for mobile organisms, requires no expert knowledge	Accepted
Line transect sampling	Objects are counted from two sides of a straight line; no restriction of distance while observing, but the sighting distance and sighting angle for each observation must be recorded	Suitable for population estimation of visible organisms, no problem for mobile organisms, but requires expert knowledge and use of DISTANCE software	Rejected
Point transect sampling	It may be considered as a line transect of zero length (i.e. a point) where the sighting (radial) distance of each of the objects are measured from random points	Suitable for areas where transect sampling is difficult due to inaccessibility; no problem for mobile organisms (if visible), but might not sufficiently cover the habitat diversity	Rejected
Opportunistic survey	Any important observation or information is recorded whenever available without following any systematic way	Suitable for recording the species diversity and other important information, but not for population density	Accepted

Slide 6

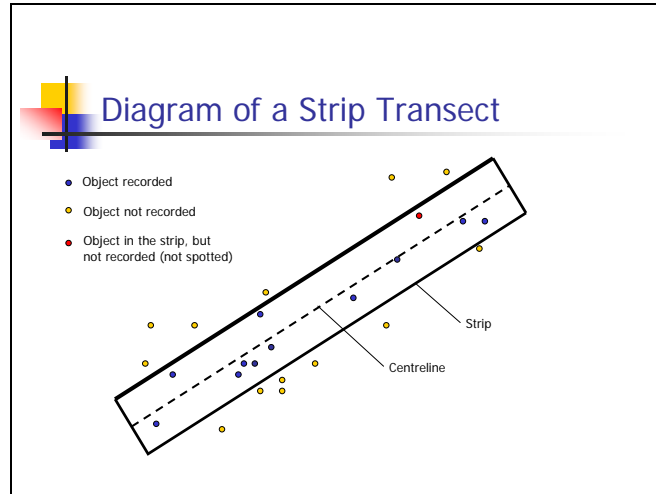


Strip Transect Sampling

In this method the observer(s) slowly walk (ca. 1.5 km/hr) on a relatively straight line through the study area and count the objects from both sides. The observation-range varies depending on the visibility of the study area. For mixed-evergreen forests of Bangladesh, the observation-range of 20 m on each side of the centreline would be suitable. The initial location of the object is always considered, because the object might move away after watching the observer(s). If any object is sighted beyond the pre-decided observation-range, or if the object is coming from the back (in order to avoid duplication), the observation is not recorded. The survey should be conducted in early mornings and late afternoons. Transects should be located in areas which are suitable in terms of accessibility and observation.

Each strip transect count is actually the total count of an area of the strip [length of the strip X width of the strip (2 X observation-range)]. Suppose there are k number of strips, each of width $2w$ (w is the observation-range on either side of the centreline), and the total length of all strips is L in a study area. If the total number of recorded objects in all strips is n , the population density D is estimated by $D = n/2wL$.

Slide 7



Slide 8

Tips to Reduce Biases in Strip Transect Sampling

- This method assumes that all objects in the strip are recorded, so the observer(s) must be very careful in observing and recording the objects. Even then, the observer(s) might miss some of the objects in the strip, but if it is not more than 5% of the total objects recorded, the error is statistically negligible.
- The more areas covered in strip transects, the less error in the result.
- The transects should be uniformly distributed throughout the study area.
- Even if any centreline is slightly undulated, the strip should be straight.
- The object should be correctly identified.

Slide 9

Opportunistic Survey

In opportunistic survey, any important or interesting observation/information is recorded at any time while in the field. Although this is an informal way of collecting information, the outcome can be very useful. The following aspects will be recorded for rare and important species of birds.

- Occurrence of a species, with its relative abundance.
- Breeding season (mating, nesting, feeding young, etc.).
- Food materials
- Calls or songs
- Threats (lack of food, lack of nesting place, lack of habitat, hunting and trapping, etc.).

Slide 10

Special Equipment Required

- One GPS (Global Positioning System)
- Five binoculars (ca. 8 X 42 or 7 X 50)
- One compass

Slide 11

Topography of a Bird


The diagram shows a brown bird in profile, facing left. Various parts of its body are labeled with lines pointing to them. The labels are: Forehead, Eye, Crown, Nape, Neck, Mantle or Back, Rump, Uppertail coverts, Tail, Wing feathers, Undertail coverts, Vent, Leg, Belly, Wing coverts, Breast, Throat, and Bill.

Slide 12

Things to Observe For Identification of a Bird

- Size and shape of the bird, particularly the tail.
- Plumage colour and markings, especially on head, wings, breast and vent.
- Structure and colour of bill and legs.
- Colour of eye/iris.
- Micro-habitat (where it was particularly seen).
- Call or song.
- Flight pattern.

Slide 13

 **Eight Indicator Bird Species**

- Greater Racket-tailed Drongo (*Dicrurus paradiseus*)
- Hill Myna (*Gracula religiosa*)
- Oriental Pied Hornbill (*Anthracoceros albirostris*)
- Red-headed Trogon (*Harpactes erythrocephalus*)
- Red Junglefowl (*Gallus gallus*)
- White-crested Laughingthrush (*Garrulax leucolophus*)
- Puff-throated Babbler (*Pellorneum ruficeps*)
- White-rumped Shama (*Copsychus malabaricus*)

Slide 14

 **Greater Racket-tailed Drongo (*Dicrurus paradiseus*)**
Local name: Bheemraj



- **Size and Shape** – Except 'rackets', size similar to a pigeon but slimmer. Two characteristic 'racket' feathers are on the tail. A crest on the forehead.
- **Colouration** – A completely glossy black bird.
- **Voice** – Very noisy. Variable whistling and screeching. Much mimicry.
- **Habits** – Inhabits forests and plantations. Often in small groups and mixed hunting groups.

Slide 15

 **Hill Myna (*Gracula religiosa*)**
Local name: Myna



- **Size and Shape** – Similar to Common Myna.
- **Colouration** – Plumage glossy black, with prominent white wing patches. Yellow-orange bill, and yellow head wattles and legs.
- **Voice** – Very vocal and an exceptional mimic. Screeches, whistles, gurgles and croaks.
- **Habits** – Inhabits mainly evergreen forests. Feeds on fruits, often with other species. Usually in pairs or small parties. Nests in high tree hole.

Slide 16


Oriental Pied Hornbill (*Anthracoceros albirostris*)
Local name: Kaw Dhanesh, Reshulla



- **Size and Shape** – Larger than a crow, with longer and broader tail and wings. A horn-like structure above the bill, which is called casque.
- **Colouration** – Mainly black upperparts and white underparts. Yellow bill and casque, with some black patches on the casque.
- **Voice** – Various high-pitched cackles and squeals. Also a fast *ka ka ka ka*.
- **Habits** – Inhabits mainly evergreen forests. Sociable and arboreal. Prefers to feed on fruits, but also feed on young birds, large insects, reptiles and rodents. Nests in high tree holes.

Slide 17

Red-headed Trogon (*Harpactes erythrocephalus*)
Local name: Lalmatha Trogon



- **Size and Shape** – Similar to a pigeon, but tail proportionately longer, broader and square-ended tail.
- **Colouration** – A mainly red and fawn-brown bird. As the name suggests, head purely red.
- **Voice** – A scaled sequence of *chaup chaup chaup* notes.
- **Habits** – Inhabits dense broadleaved forests. Sits for long periods high in trees. Fly-catches in canopies, but also eats fruits. Solitary or in pairs.

Slide 18

Red Junglefowl (*Gallus gallus*)
Local name: Bon Morog/Murgi



- **Size and Shape** – Similar to indigenous domestic fowl.
- **Colouration** – Male has golden brown hackles covering neck and back, golden and green wings and black underparts. Long, curved black tail. Red comb and wattles. Female speckled reddish brown, with small red comb and wattle.
- **Voice** – Shrill rushed crow *kuk kurdi ru*.
- **Habits** – Inhabits forests and secondary growths. Feeds in groups. Roosts in trees.


Slide 19


 **White-crested Laughingthrush** (*Garrulax leucolophus*)
Local name: Sada-jhuti Panga



- **Size and Shape** – Similar to Jungle Babbler.
- **Colouration** – A brown bird with white head and crest, and black eye-patch.
- **Voice** – Very noisy. Various chattering calls and whistling, often delivered in chorus by flock.
- **Habits** – Inhabits forest undergrowth, secondary scrub and bamboos. Feeds on invertebrates and fruits. Always in parties. Nests in shrub or tree.

Slide 20

 **Puff-throated Babbler** (*Pellorneum ruficeps*)
Local name: Phota-konhi Satbhaila



- **Size and Shape** – Slightly smaller than Jungle Babbler, but shape similar to Jungle Babbler.
- **Colouration** – A brown bird with strongly spotted underparts.
- **Voice** – Loud call *tee teu*. Extended loud mellow song.
- **Habits** – Inhabits forest undergrowth and bamboo thickets. Feeds singly or in pairs on invertebrates, mainly on ground.


Slide 21

 **White-rumped Shama** (*Copsychus malabaricus*)
Local name: Shama



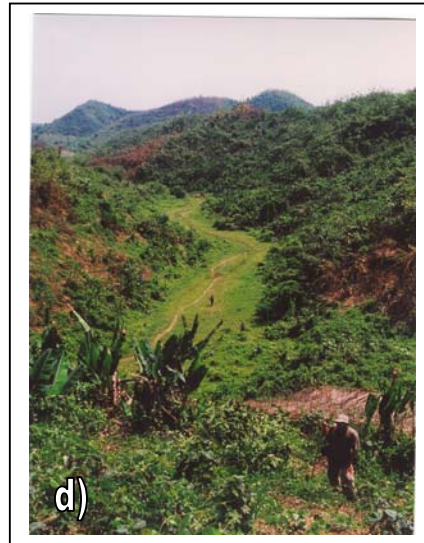
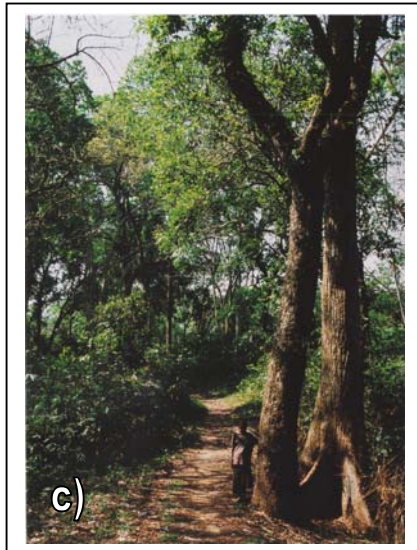
- **Size and Shape** – Similar to Oriental Magpie Robin, but with much longer tail.
- **Colouration** – A black and orange bird with a large, white back patch. Female paler than the male.
- **Voice** – A harsh *chrrr* call. Very rich song often with mimicry.
- **Habits** – Inhabits forest undergrowth, favouring bamboo. Frequently cocks tail. Feeds on invertebrates. Nests low down.

Slide 22

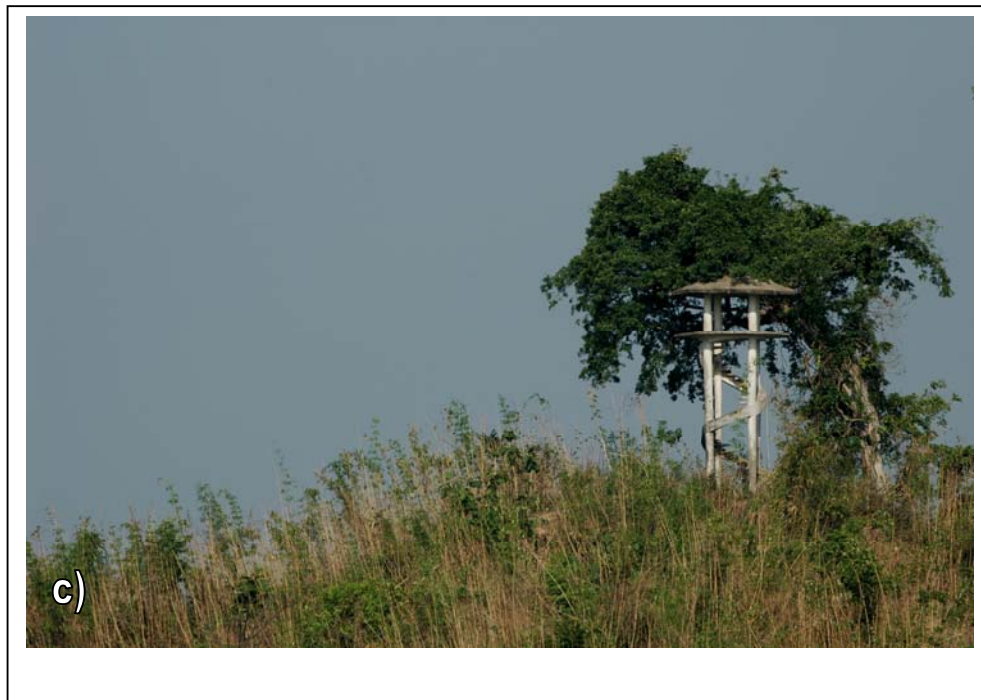
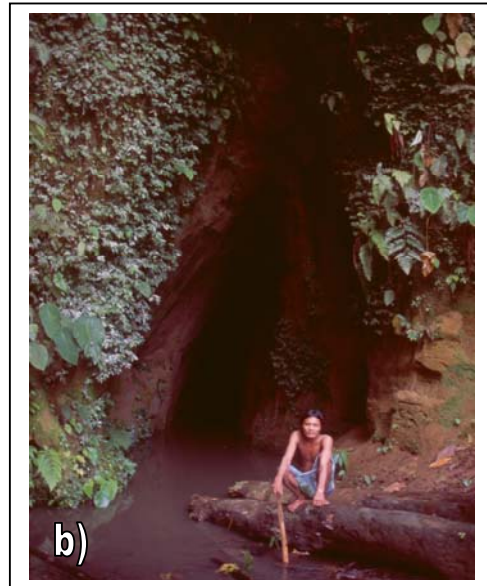


Selected Reading

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- Grimmett, R., Inskipp, C. and Inskipp, T. 1999. *Pocket Guide to the Birds of the Indian Subcontinent*. Christopher Helm, London. 384 pp. (For identification of birds.)
- Grewal, B., Harvey, B. and Pfister, O. 2002. *A Photographic Guide to the Birds of India*. Christopher Helm, London. 512 pp. (For identification of birds.)
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- IUCN Bangladesh 2000. *Red Book of Threatened Birds of Bangladesh*. IUCN – The World Conservation Union, Dhaka. (For threatened birds and a list of birds in Bangladesh.)
- Pettingill, O.S. 1969. *A Laboratory and Field Manual of Ornithology*. Burgess Publishing Company, Minnesota. 381 pp. (For methods and identification of birds.)
- Thompson, P.M. and Johnson, D.L. *Birding in Bangladesh: A Guide to Birdwatching Sites and a Checklist of Birds*. Unpublished report, Dhaka. 51 pp. (For a list of birds found in different habitats of Bangladesh.)



View of five NSP sites: a) Lawachara National Park, b) Satchori National Park, c) Rema-Kalenga Wildlife Sanctuary, d) Chunati Wildlife Sanctuary, and e) Teknaf Game Reserve.



Tourist attractions in NSP sites: a) Rema Tea Estate beside Rema-Kalenga, b) Kudum Cave in Teknaf, and c) Watchtower in Chunati.

Plate 2



Scouts and Rovers learning bird survey techniques in Lawachara.

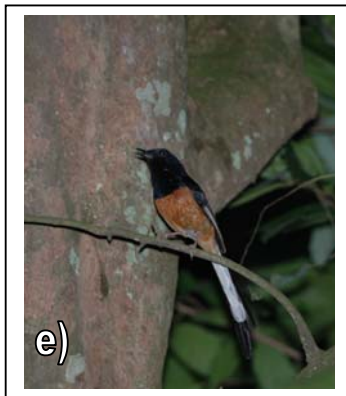
Plate 3



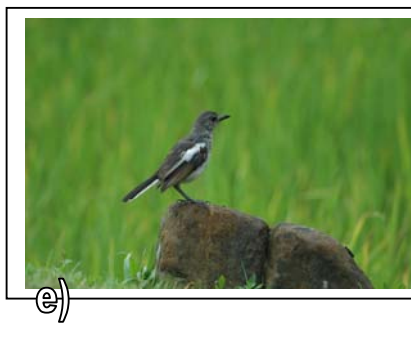
Activities in NSP sites during bird survey: a) crossing a stream in Rema-Kalenga, b) setting a remote camera-trap to photograph ground birds in Teknaf, c) climbing a big tree to observe birds of the upper canopy in Satchori, and d) observing birds in Rema-Kalenga.



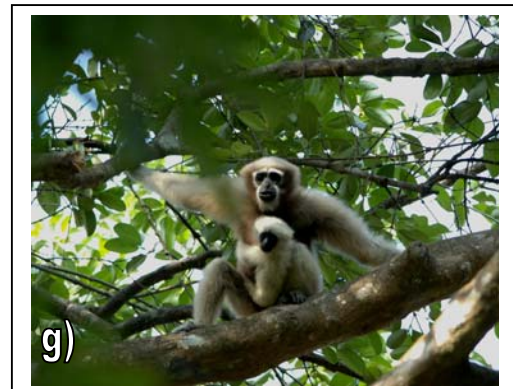
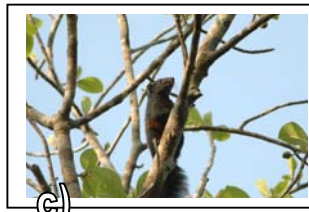
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Eight indicator bird species: a) Red Junglefowl, b) Oriental Pied Hornbill, c) Red-headed Trogon, d) Greater Racket-tailed Drongo, e) White-rumped Shama, f) Hill Myna, g) White-crested Laughingthrush, and h) Puff-throated Babbler.



Some birds of NSP sites other than the indicators: a) Crimson Sunbird in Chunati, b) Red-breasted Parakeet in Teknaf, c) Thick-billed Green Pigeon in Lawachara, d) Black-hooded Oriole in Chunati, e) Oriental Magpie Robin in Teknaf, f) Indian Cuckoo in Rema-Kalenga, g) Ruby-cheeked Sunbird (female) in Satchori, and h) Lineated Barbet in Rema-Kalenga.

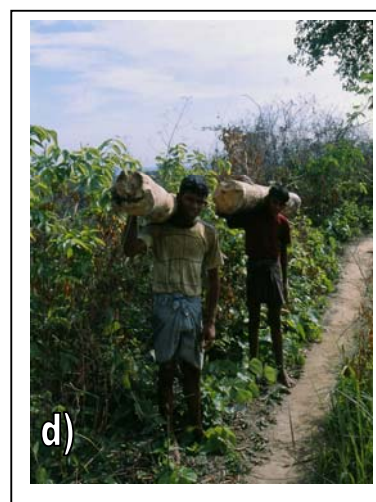


Some important wildlife (except birds) of NSP sites: a) Tree Frog (*Polypedates leucomystax*) in Teknaf, b) Common Garden Lizard (*Calotes versicolor*) in Lawachara, c) Orange-bellied Himalayan Squirrel (*Dremomys lokriah*) in Rema-Kalenga, d) Slow Loris (*Nycticebus coucang*) in Rema-Kalenga, e) Asian Elephant (*Elephas maximus*) in Teknaf, f) Hoolock Gibbon (*Hylobates hoolock*) male in Lawachara, and g) Hoolock Gibbon (*Hylobates hoolock*) female with baby in Lawachara.



Some rare flowers and fruits in NSP sites: a) *Hedychium coccineum* – one of the least-known plants in Bangladesh, found in Rema-Kalenga, b) 'ulat chandal' (*Gloriosa superba*) in Teknaf, c) a species of *Ixora* with white flowers in Teknaf, d) 'makal' (*Hodgsonia macrocarpa*) fruits in Lawachara, and e) 'ury aam' or wild mango (*Mangifera sylvatica*) fruits.

Plate 8



Threats to the birds and their habitats: a) hill-cutting to supply soil in the brick field in Chunati, b) intentional burning of forest floor in order to clear non-timber plants in Rema-Kalenga, c) clearing of hill forest for ‘jhum’ (shifting) cultivation in Toynga Hill, Teknaf, and d) two poachers with illegally-cut logs in Teknaf.

Plate 9