Nishorgo Support Project

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

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Prepared for

International Resources Group (IRG)

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

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SUMMARY

Participatory bird survey was taken as the tool to assess the management impacts in five protected areas, situated in the northeast and southeast of Bangladesh, where Nishorgo Support Project (NSP) is working to improve the management system. Unlike animals of other taxa, birds are more visible and more responsive to any change. Therefore, birds are treated as one of the best indicators of the ecological changes of their habitats.

This was the third year survey (2007) of systematic yearly surveys. The fieldwork continued from March to August (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. 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 in this year were estimated at: Lawachara National Park – 13.12, 12.00, 4.01, 32.20, 90.01, 21.46, 0.00, 32.38; Satchori National Park – 14.05, 13.56, 3.51, 33.78, 86.98, 12.22, 0.00, 38.91; Rema-Kalenga Wildlife Sanctuary – 14.33, 7.06, 2.13, 36.84, 64.90, 9.98, 0.00, 24.87; Chunati Wildlife Sanctuary – 16.19, 0.00, 0.00, 10.00, 23.82, 7.27, 5.08, 14.60; and Teknaf Game Reserve – 11.03, 9.67, 1.18, 37.31, 18.17, 32.44, 0.00, 19.28.

When this year's density estimates were compared with those of the two previous years, it was found that two of the indicator birds (Red Junglefowl and Puff-throated Babbler) that live in the understory of the forest are increasing significantly. 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 are still going on in some areas, which is probably causing the decline of the Oriental Pied Hornbill population. 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 three years.

A total of 225 species of birds was recorded in five NSP sites, of which 190 (84%) were resident and the rest 35 (16%) migrant. Out of 225 species, 37 (17%) were Very Common, 65 (29%) Common, 41 (18%) Uncommon and 82 (36%) Rare. This shows that the largest proportion of birds is Rare, which requires monitoring and protection. Over the last three years no significant difference was found in the proportions of the number of species of primarily forest birds in relation to the total birds in any of the five NSP sites.

Chapter 1

INTRODUCTION

PARTICIPATORY BIRD SURVEY TO ASSESS PROTECTED AREA MANAGEMENT IMPACTS: *THIRD YEAR REPORT*

1. INTRODUCTION

Participatory bird survey was taken as the tool to assess the management impacts in five protected areas, situated in the northeast and southeast of Bangladesh, where Nishorgo Support Project (NSP) is working to improve the management system. Unlike animals of other taxa, birds are more visible and more responsive to any change. Therefore, birds are one of the best indicators of the ecological changes of their habitats. Different species of birds live in different strata of an area and are adapted to varied types of plant and animal food. Therefore, the avian population density and species diversity strongly reflects the temporal changes of their habitat conditions. In other words, birds indicate the health of different strata of the forest.

Unlike many small countries, 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 km^2, 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 Sates, each of which is about 800. The total number of bird species recorded in Bangladesh is 50% of the total of the Indian Subcontinent, and 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, together with improper management. 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 habitants, 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 20º34′-26º33′ N latitudes and 88º01′-92º41′ 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 km^2, 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 34ºC and 21ºC, respectively. The average maximum and minimum temperatures in winter are 29ºC and 11ºC, 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 km^2, 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 km^2 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 km^2 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 km^2, 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).

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°4500′ 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	Madhutila	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
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 km^2	

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-sewing. The five sites where the bird survey took place are –

2.1 Lawachara National Park

This is an area of 12.5 km^2 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 'chapalish' (*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 Gobbon (*Bunipithecus hoolock*). Other important wildlife are Capped Langur (*Trachypithecus pileatus*), Phayre's Langur (*Trachypithecus phayrei*), Pig-tailed Macaque (*Macaca nemestrina*), Orange-bellied Himalayan Squirrel (*Dremomis lokriah*), Barking Deer (*Muntiacus muntjac*) and Masked Civet (*Paguma larvata*). The surrounding habitants 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 km^2) 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 'chapalish' (*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 km^2 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 'chapalish' (*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 km^2), 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 'chapalish' (*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

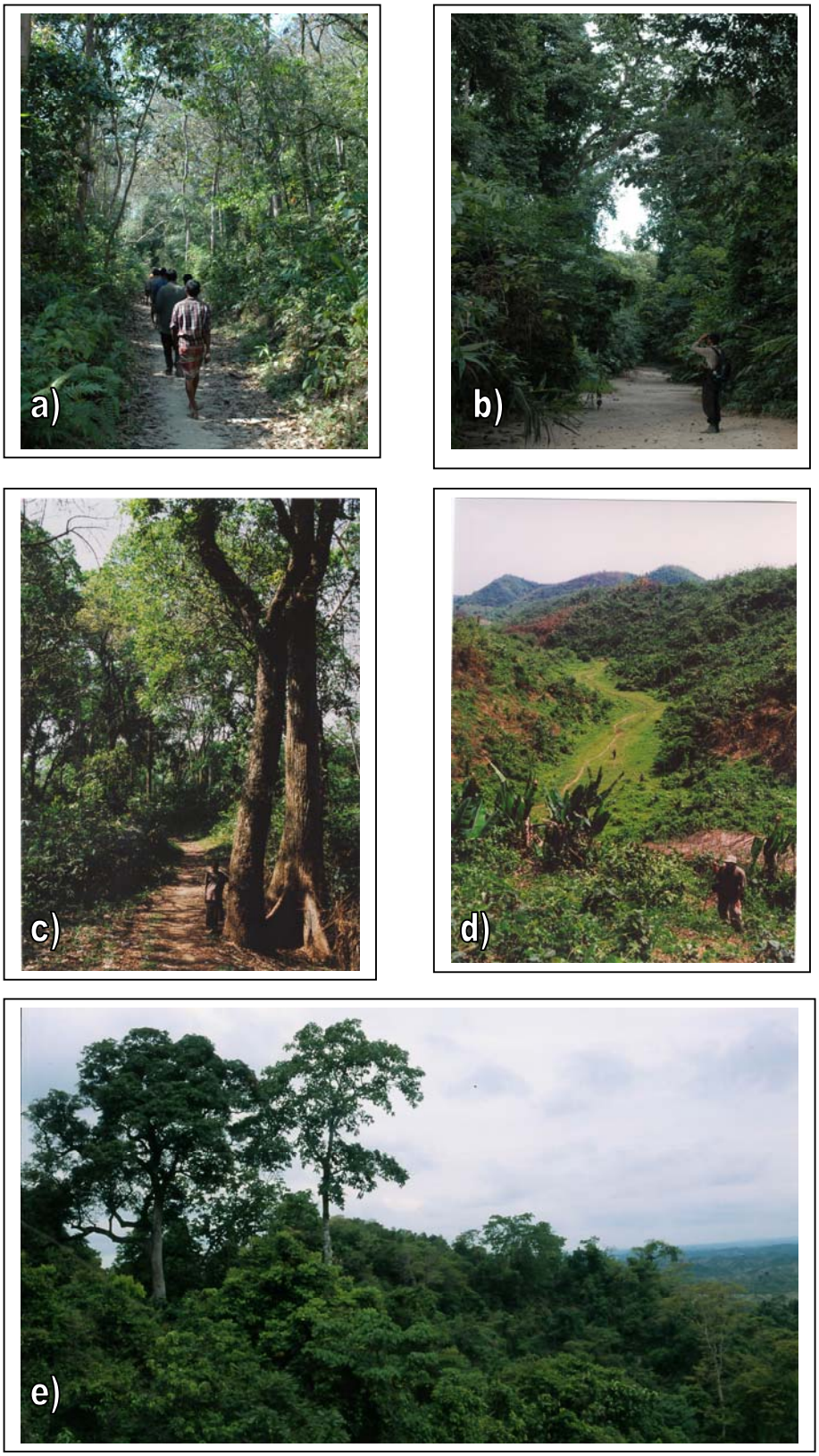
agriculture (paddy, lemon and betel leaf) and fish farming, but some of them illegally harvest the bamboo and other forest products. There are five transects for bird survey in this Sanctuary, which are given in Table 2.

2.5 Teknaf Game Reserve

This is the largest (116.2 km^2) 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*), 'chapalish' (*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 'chapalish' 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



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, c) Watchtower in Chunati, d) Waterfall in Kudum Hill, Teknaf, and e) Cooty Cliff in Kudum Hill, Teknaf.

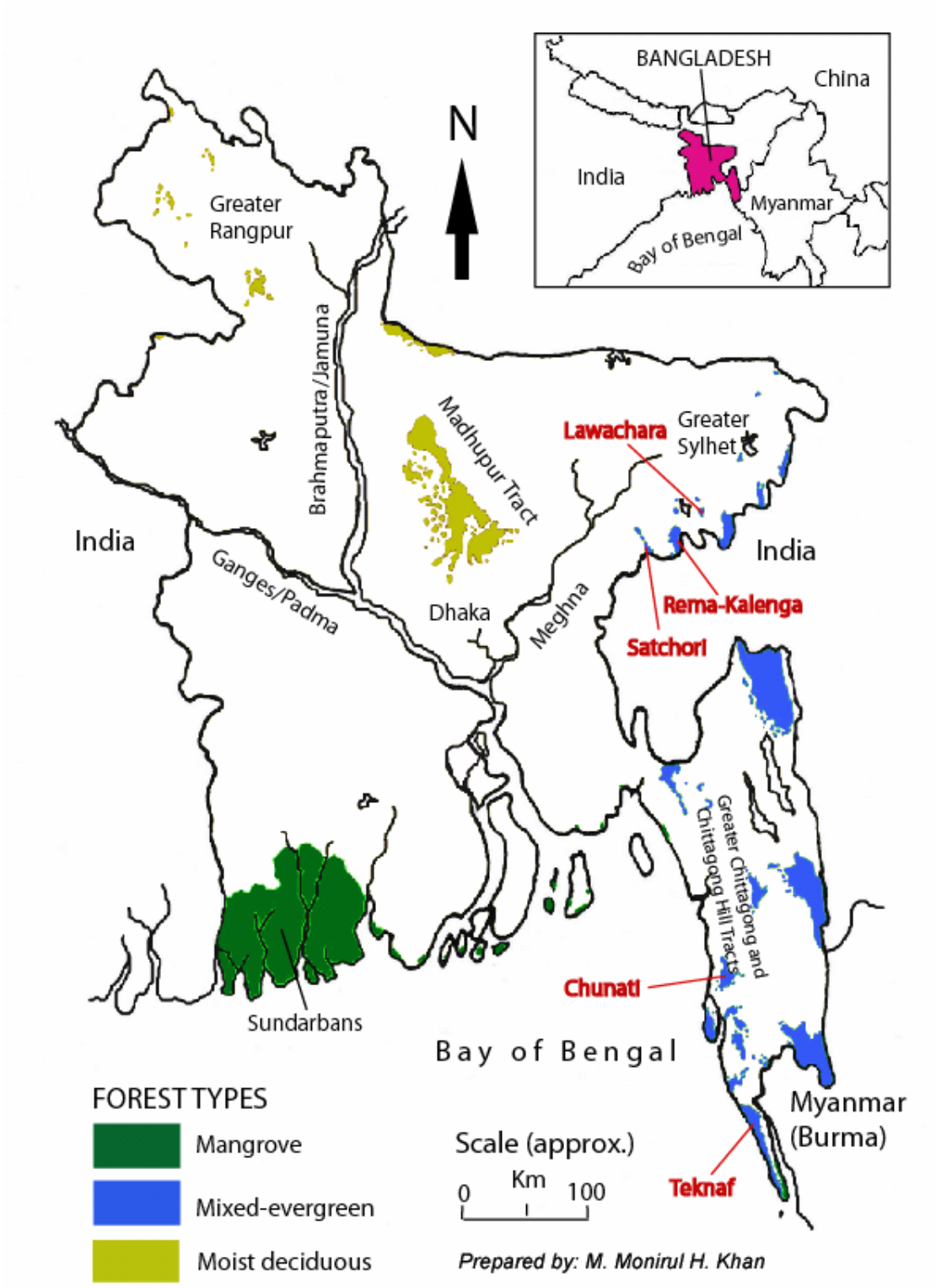


Figure 1. Forested areas of Bangladesh showing the locations of five sites under Nishorgo Support Project (NSP).

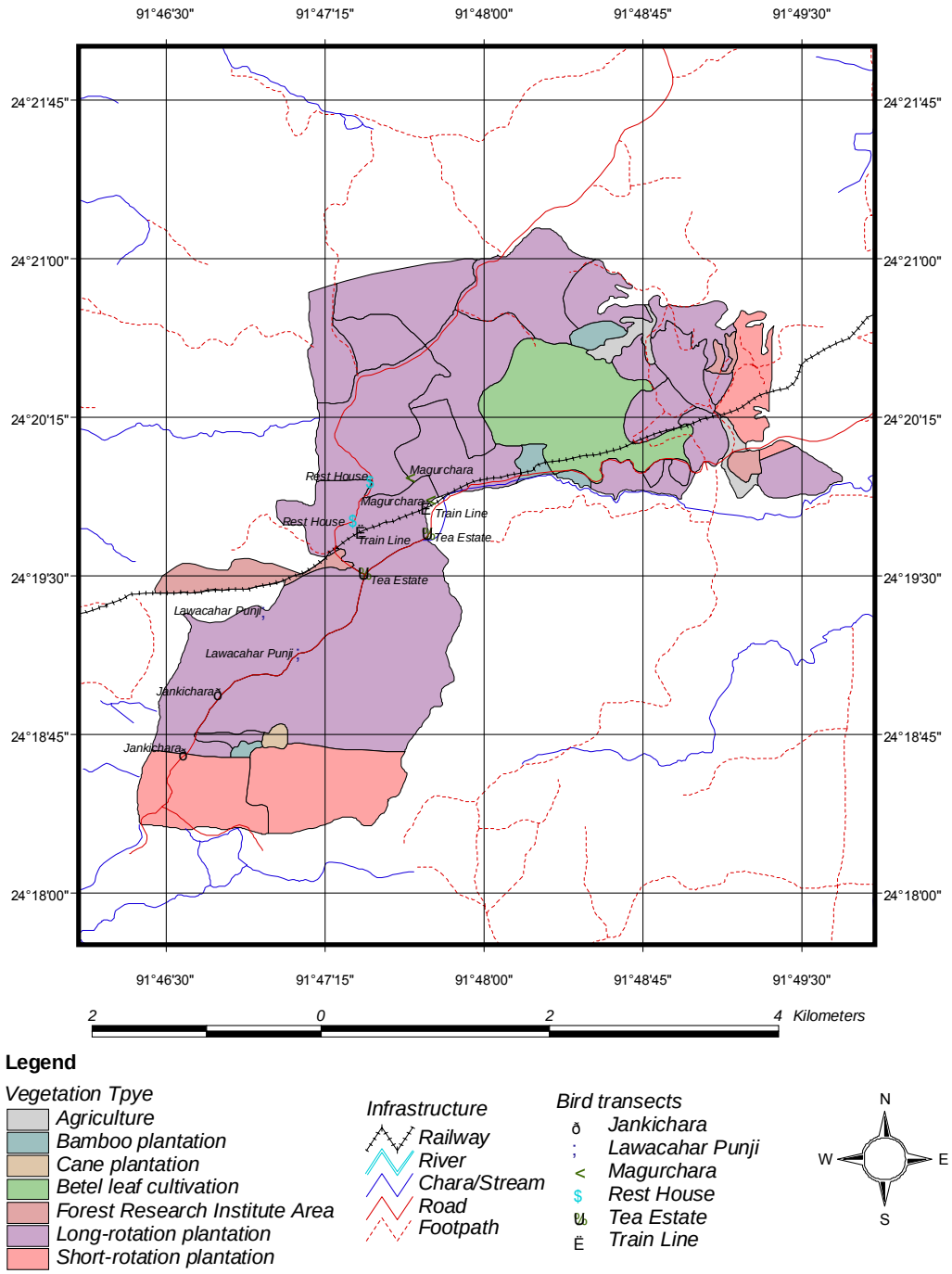


Figure 2. Lawachara National Park showing the starting and ending points of bird survey transects

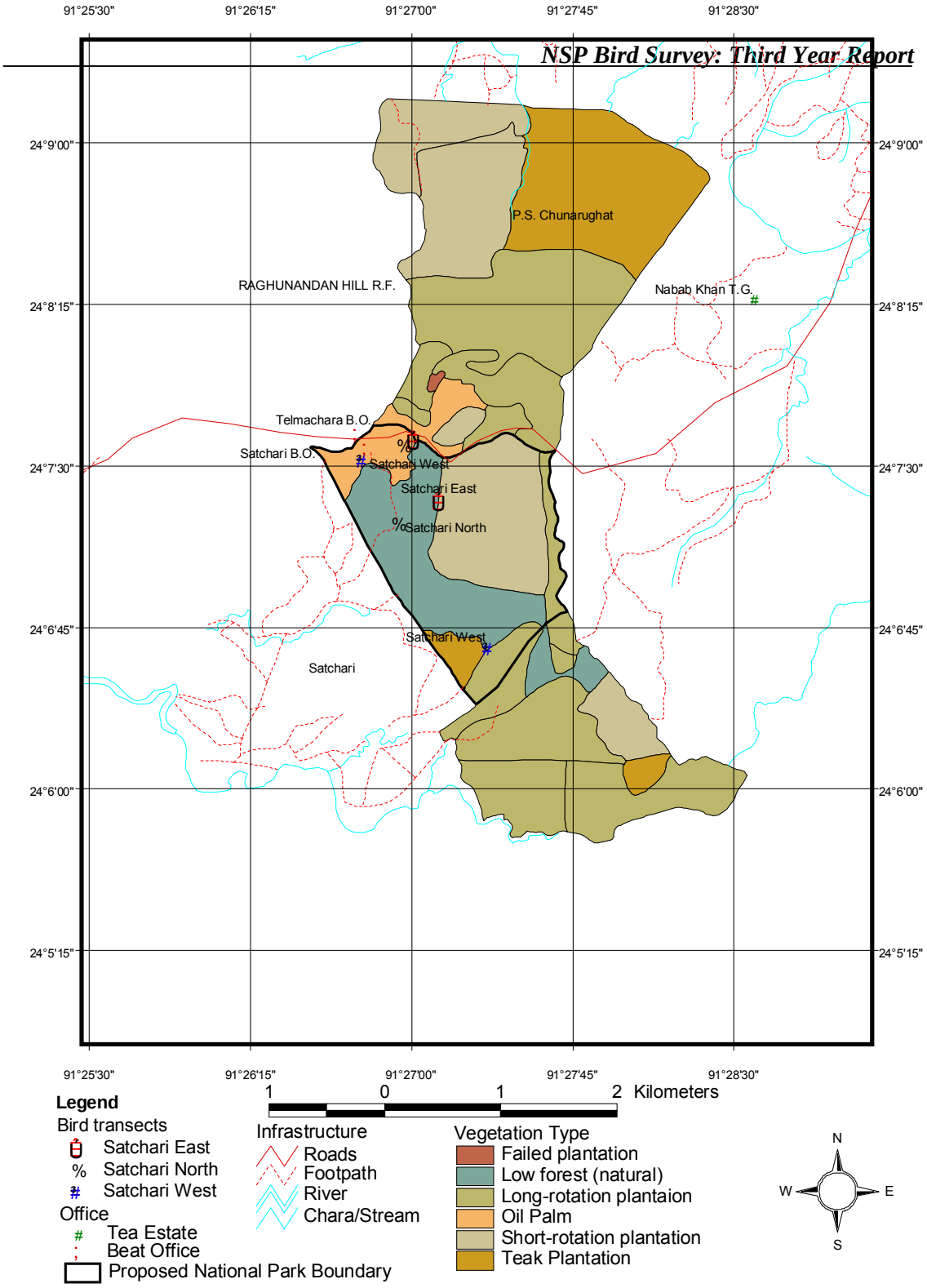


Figure 3. Satchori National Park showing the starting and ending points of bird survey transects

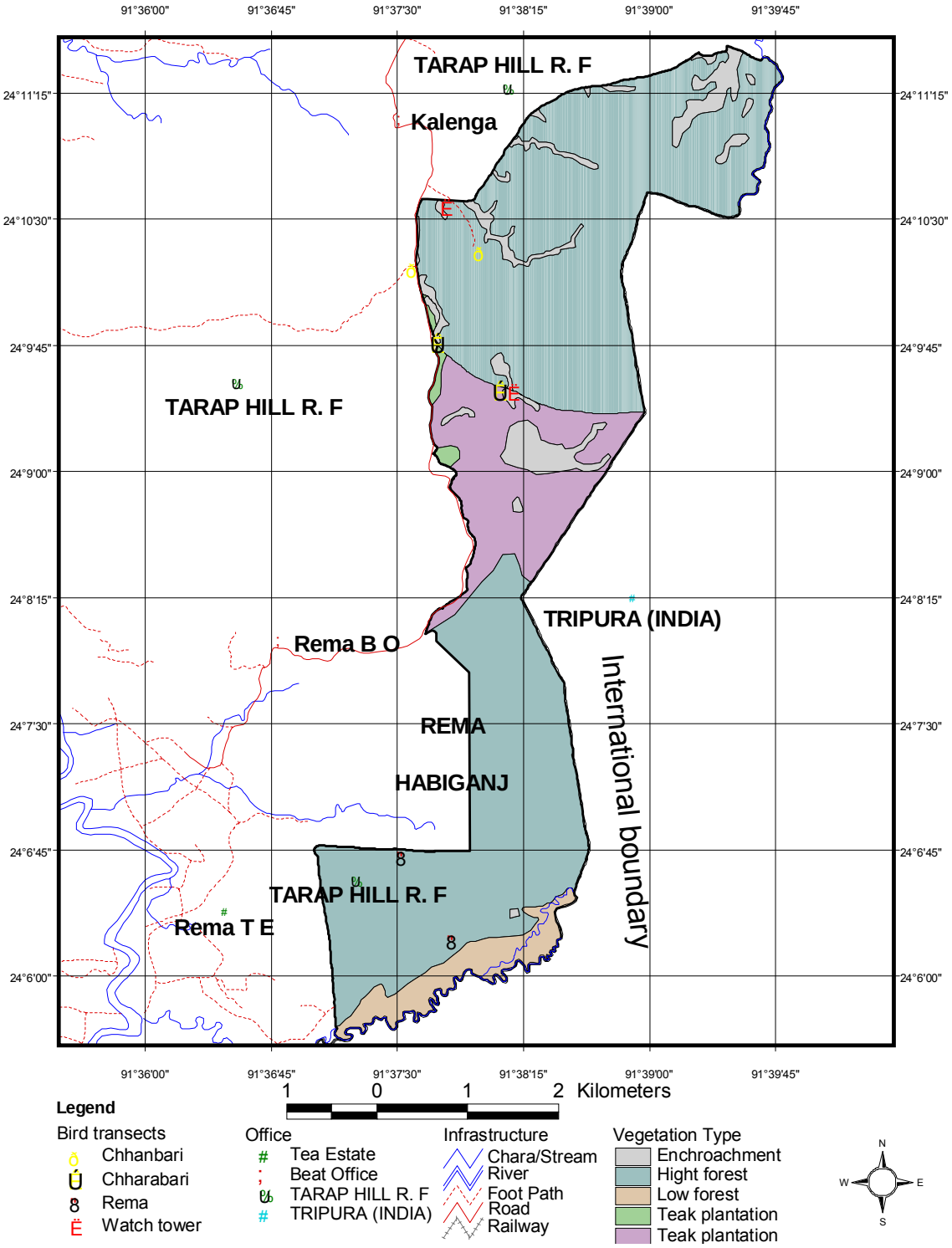


Figure 4. Rema-Kalenga Wildlife Sanctuary showing the starting and ending points of bird survey transects

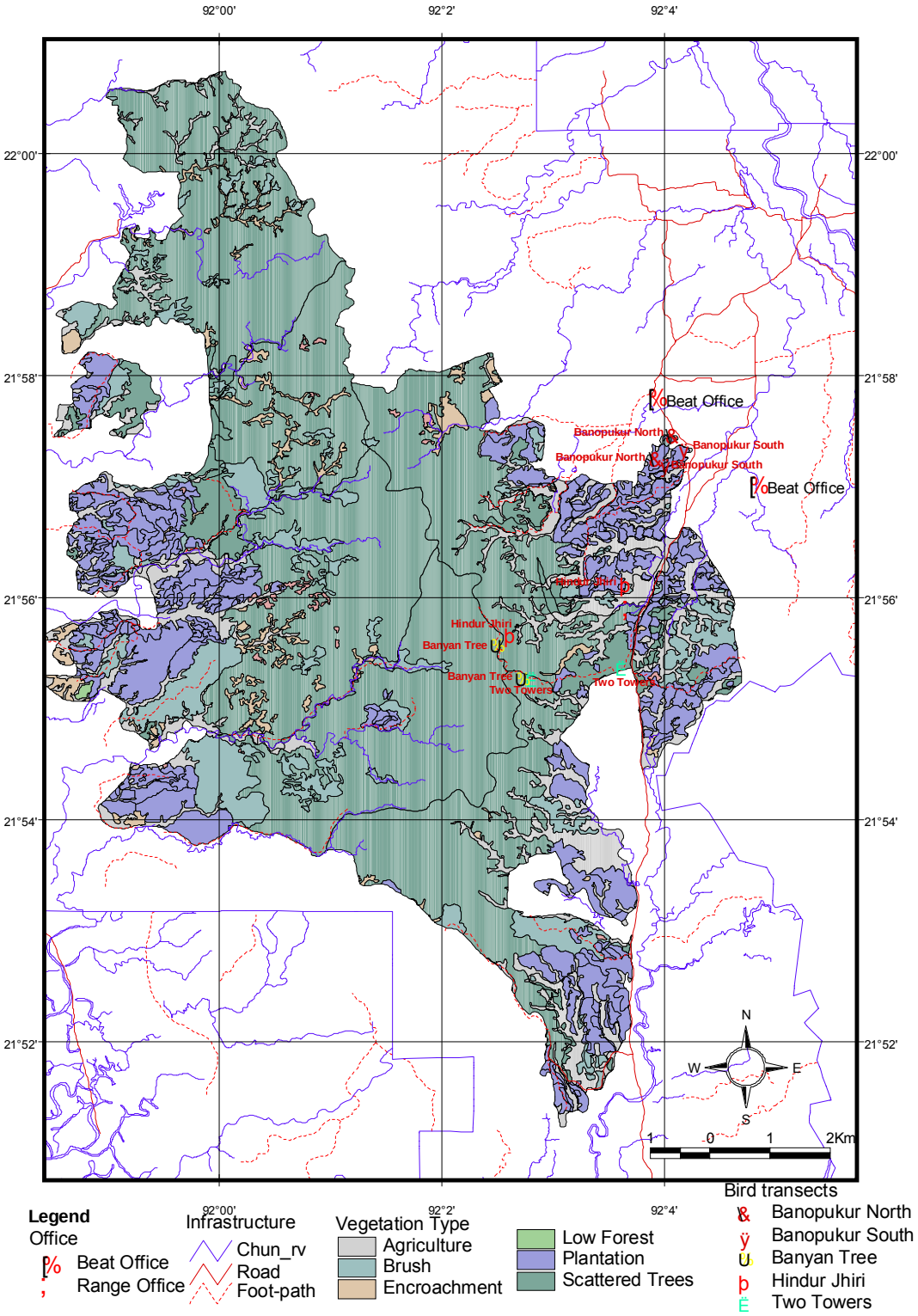


Figure 5. Chunati Wildlife Sanctuary showing the starting and ending points of bird survey transects

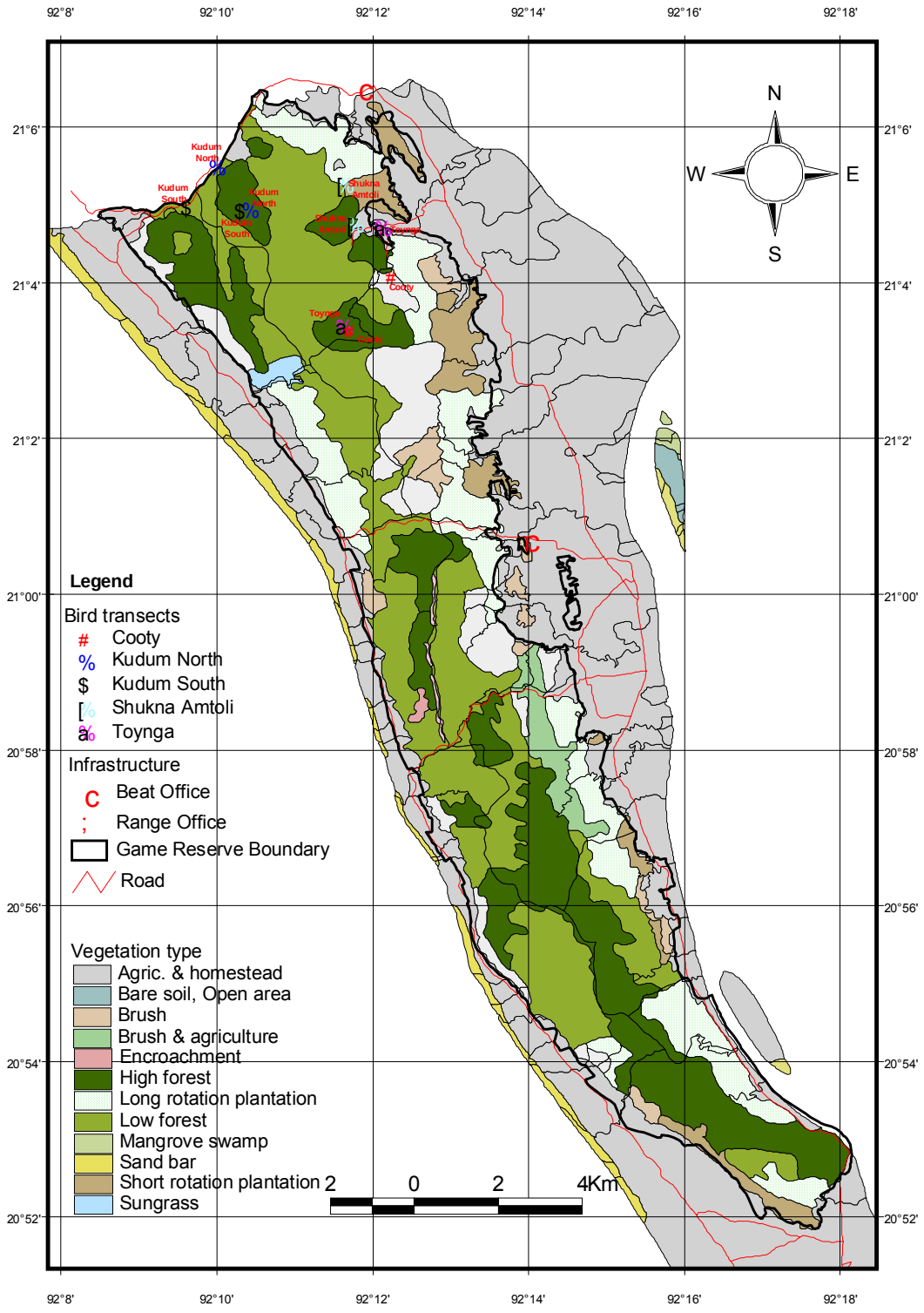


Figure 6. Teknaf Game Reserve showing the starting and ending points of brid survey transects

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 filed, 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. 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. Moreover, a pair of Motorola two-way radios (range: 8 km) were used for communication, when the survey team was divided into two groups.

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). 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	*Gallus gallus*	Lower
2	Oriental Pied Hornbill	*Anthracoceros albirostris*	Upper
3	Red-headed Trogon	*Harpactes erythrocephalus*	Middle
4	Greater Racket-tailed Drongo	*Dicrurus paradiseus*	Middle
5	White-rumped Shama	*Copsychus malabaricus*	Middle

6	Hill Myna	*Gracula religiosa*	Upper
7	White-crested Laughingthrush	*Garrulax leucolophus*	Lower
8	Puff-throated Babbler	*Pellorneum ruficeps*	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, including the local Ecotour Guides and Co-management Council members, together with the local officials of the Forest Department. 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 leader of BBC. The whole survey team was lead by a wildlife expert (Dr M. Monirul H. Khan) from Jahangirnagar University, Savar, Dhaka. The team members were trained during the survey so that they could play significant role in the survey process in the future. See Appendix II for the names and addresses of the survey team members who were attended this year's (2007) survey.

3.4 Bird Survey Methods

The bird survey was first started in the year 2005, which was repeated in 2006 and 2007. 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-August), 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
Oppor-tunistic 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**

3.4.1 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 2*w* (*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

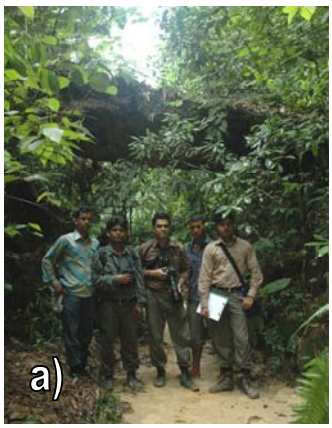
misidentification. The main weakness of this method is that the error cannot be estimated.

3.4.2 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.)



Bird survey related activities in NSP sites: a) strip transect sampling in Satchori, b) bird survey team with Forest Department officials and Co-management Council members in Chunati, c) interviewing local people in Chunati, d) setting remote camera-trap in Satchori to photograph ground birds, and e) strip transect sampling in Lawachara

Hazards during bird survey: a) our microbus had a fatal accident in Balukhali, Teknaf, and b) our jeep partially fell through broken culvert in Whykeong, Teknaf

Chapter 4

RESULTS AND DISCUSSION

4. RESULTS AND DISCUSSIONS

The survey was conducted during a six-month period (March-August 2007), 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 third year (2007), during their breeding season, new additions of bird names in the two previous years' (2005 and 2006) list of all birds, and the comparison of this year's findings with the two previous years' 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 repeated 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 two previous years (2005 and 2006), the population density, i.e. the number of individuals per square kilometer, was estimated in this year (2007) 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 two previous years, 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 tow previous years' 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 three years (Figure 9). This indicates that the forest understory has started regenerating, which caused the increment of the carrying capacity and nesting sites for these tow 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 the decline of the Oriental Pied Hornbill over the last three years (Figure 9). 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 three year (Figure 9).

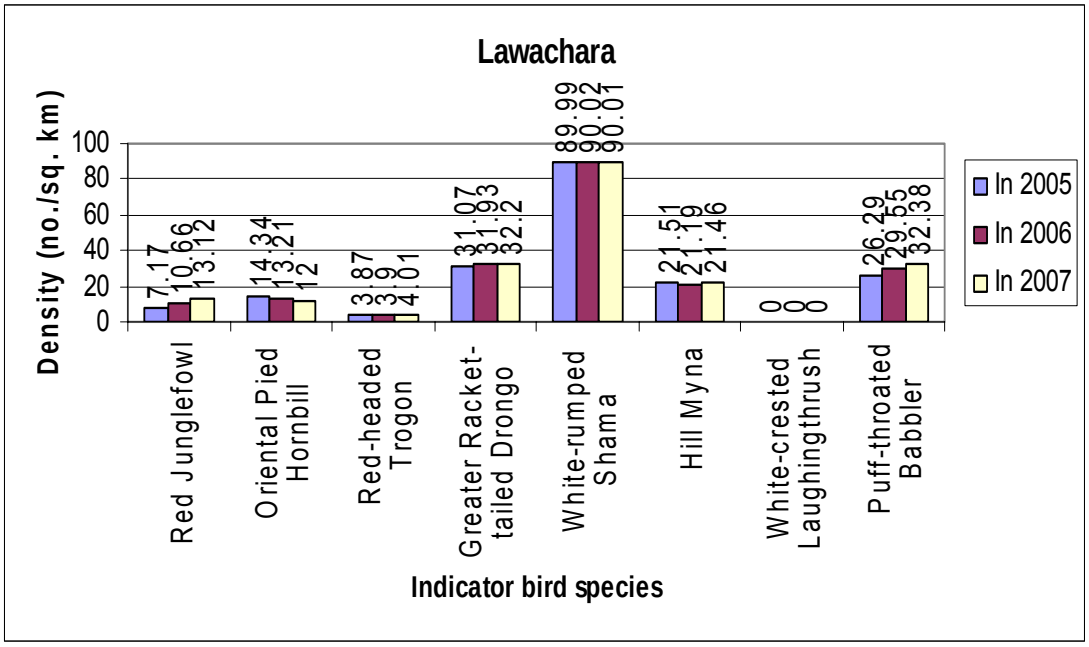


Figure 7a. Population density (no./sq. km) of eight indicator bird species in Lawachara National Park in 2005, 2006 and 2007.

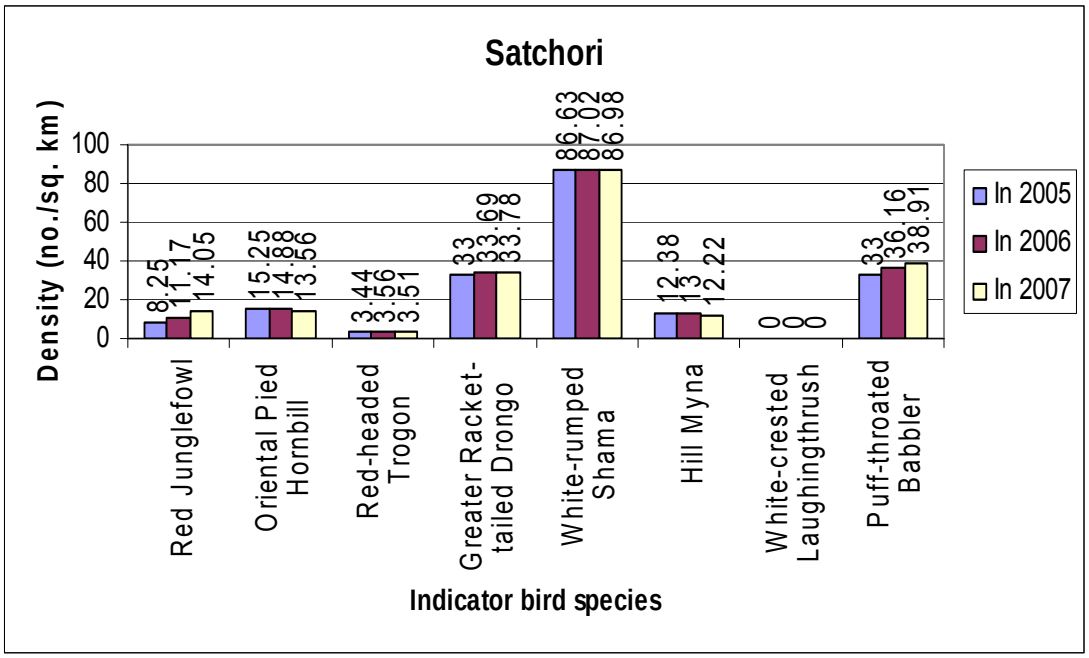


Figure 7b. Population density (no./sq. km) of eight indicator bird species in Satchori National Park in 2005, 2006 and 2007.

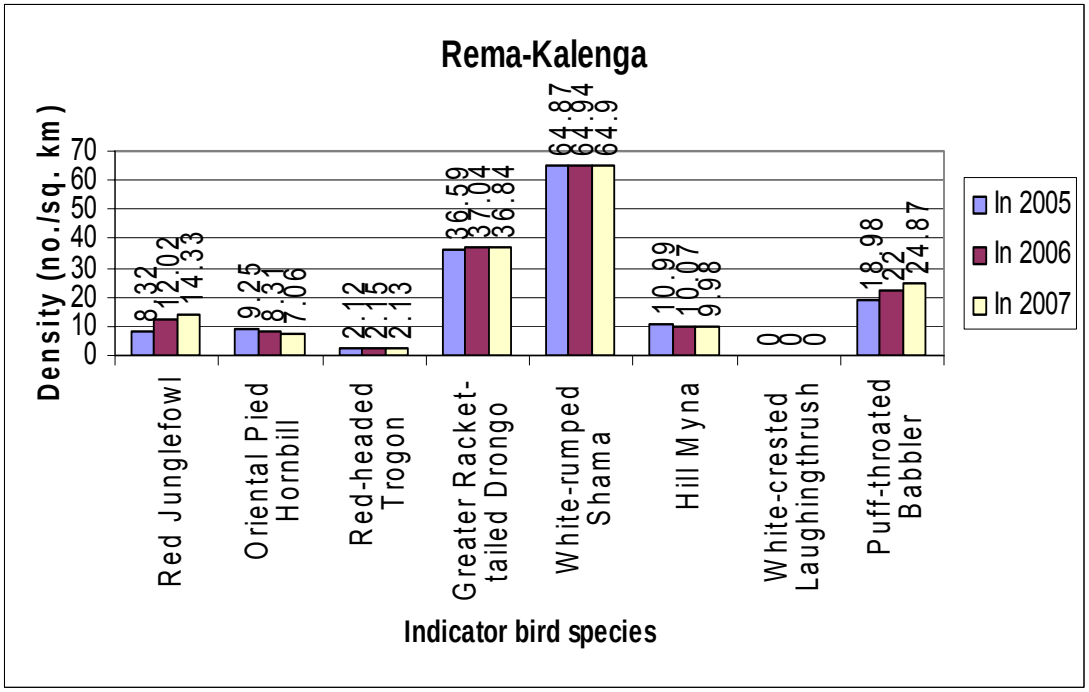


Figure 7c. Population density (no./sq. km) of eight indicator bird species in Rema-Kalenga Wildlife Sanctuary in 2005, 2006 and 2007.

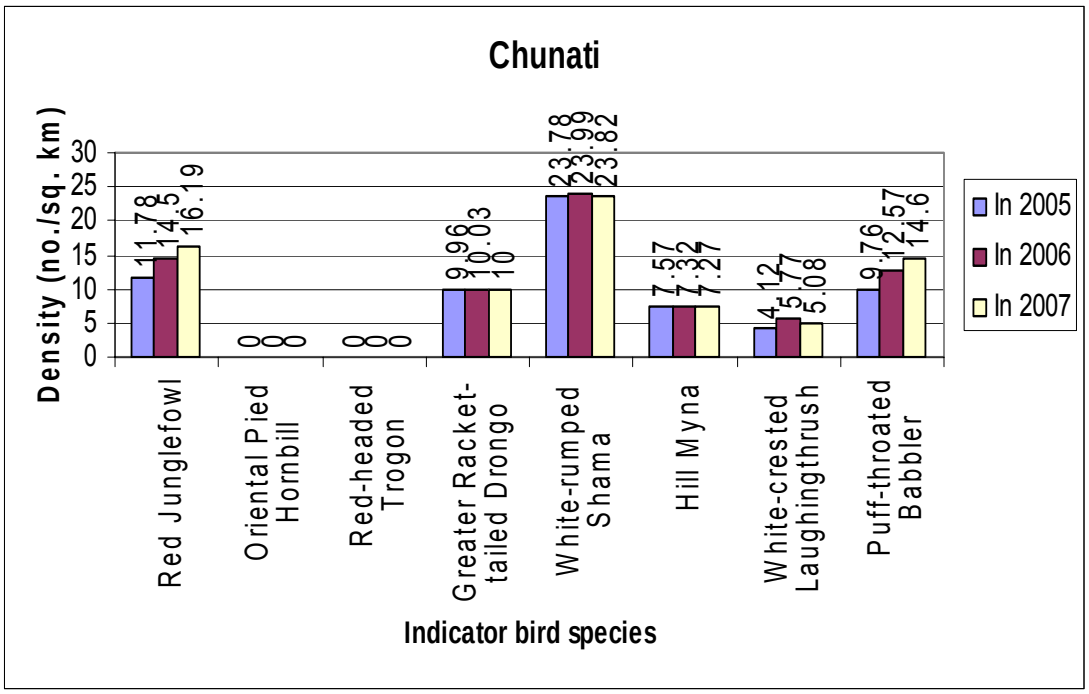


Figure 7d. Population density (no./sq. km) of eight indicator bird species in Chunati Wildlife Sanctuary in 2005, 2006 and 2007.

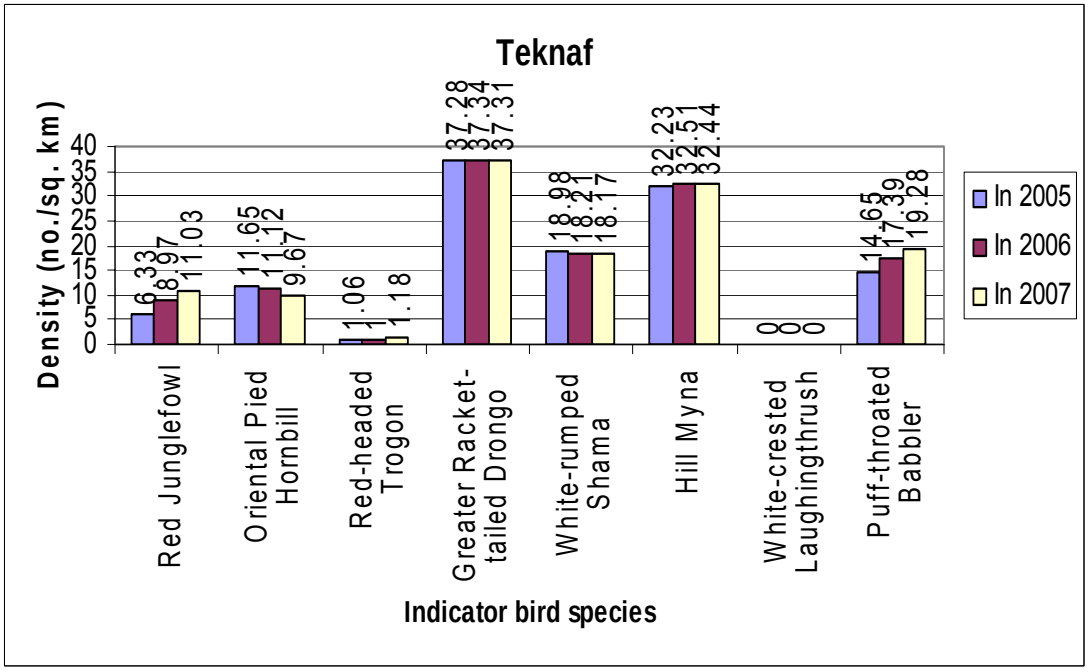


Figure 7e. Population density (no./sq. km) of eight indicator bird species in Teknaf Game Reserve in 2005, 2006 and 2007.

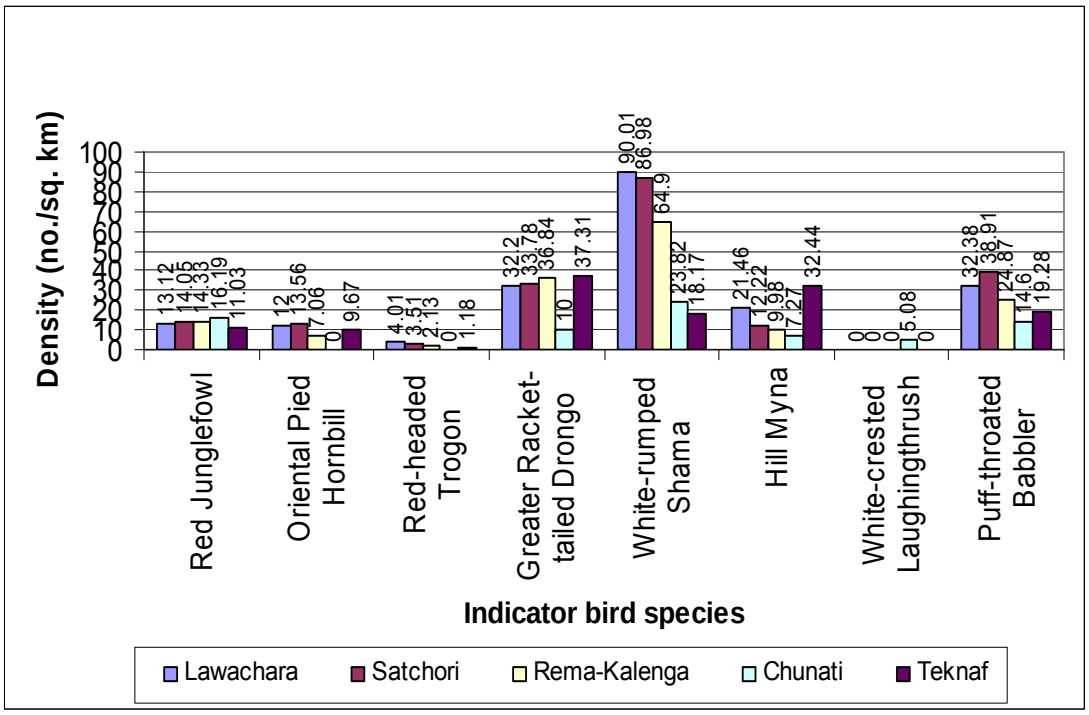


Figure 8. Comparison of the population density of eight indicator bird species across five NSP sites in 2007.

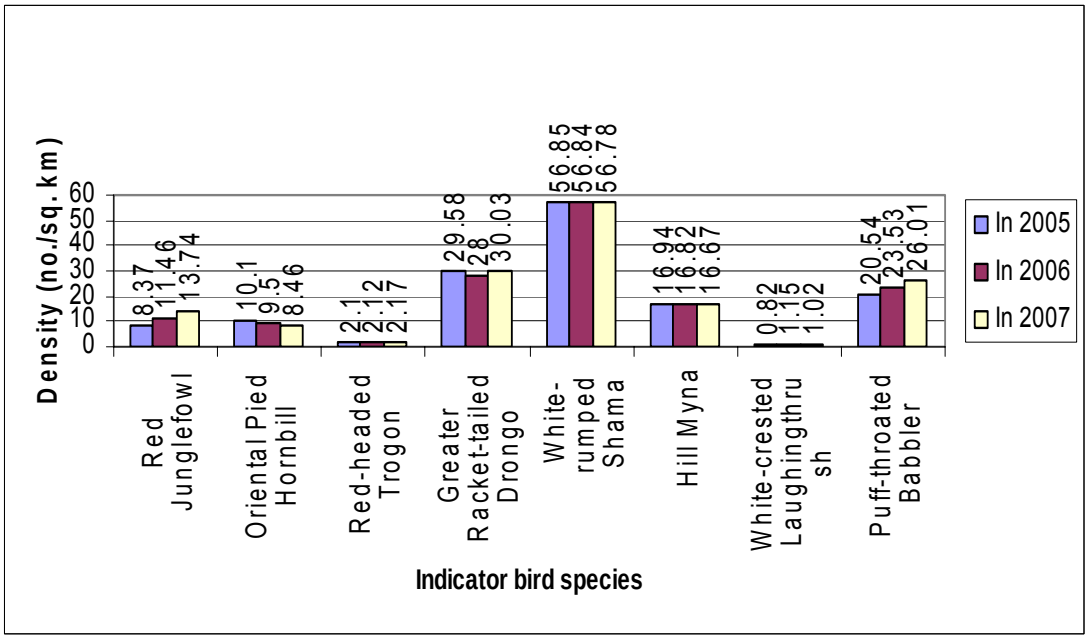


Figure 9. Comparison of the population density of eight indicator bird species across five NSP sites in 2007.

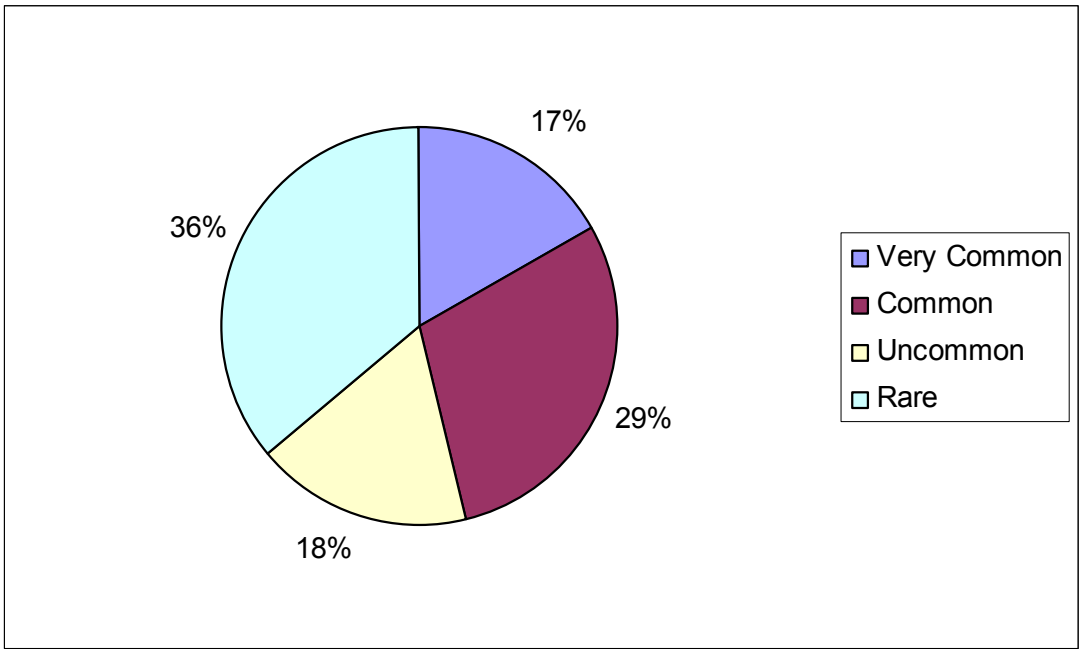


Figure 10. Proportions of Very Common, Common, Uncommon and Rare species of birds in NSP sites in 2007.

4.2 Bird Species Diversity

During the avian breeding season (February-August) of last three years (2005-2007), a total of 225 species of birds have been recorded in five NSP sites, of which 190 (84%) were resident and the rest 35 (16%) migrant (Table 5). Among the resident birds, a total of 9 species are known to migrate locally. Out of 225 species, 37 were Very Common, 65 Common, 41 Uncommon and 82 Rare (Figure 10). The proportion of Rare birds has increased in this year (36%) compared to the two previous years.

The total bird species (225) 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 (36%) 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 225 species of birds, the total number of species and the total number of primarily forest species were different in five different sites (Figure 11). Strong correlation (r = 0.83088) 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.

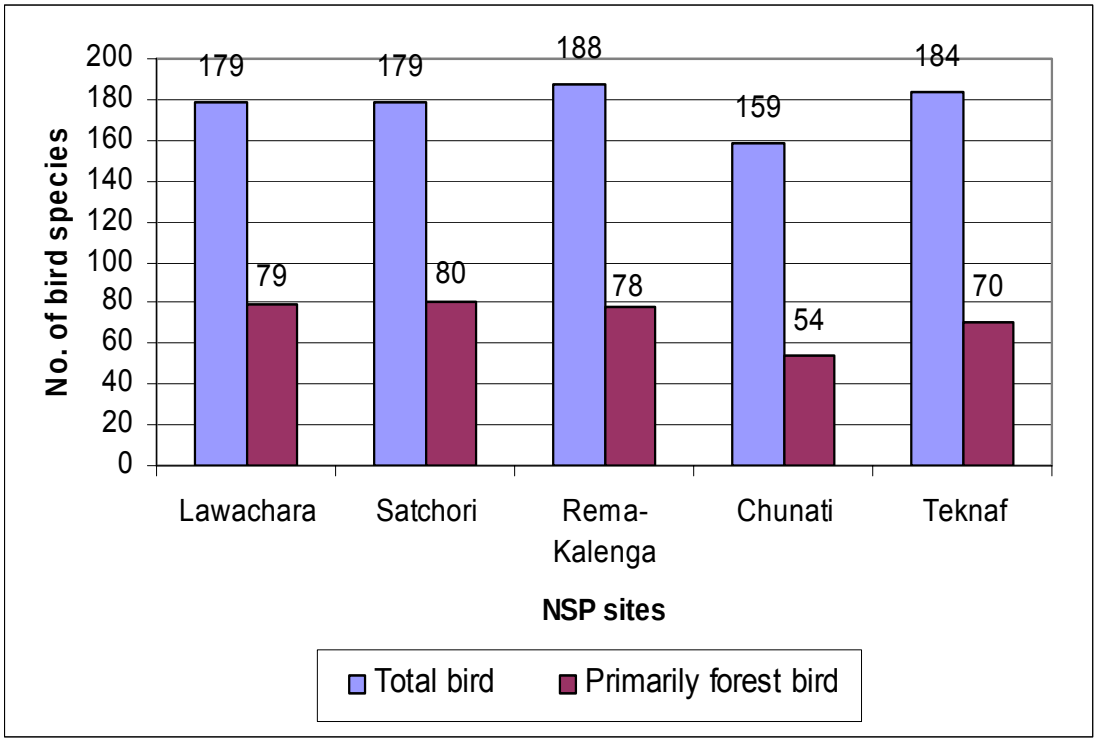


Figure 11. A comparison of the total number of bird species and total number of primarily forest bird species across five NSP sites in 2007.

Table 5. List of birds recorded in five NSP sites (Lawachara, Satchori, Rema-Kalenga, Chunati and Teknaf), during 2005-2007, 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	*Coturnix coturnix*	r, M	W
2	White-cheeked Partridge*	*Arborophila atrogularis*	r, R	L, S, RK
3	Red Junglefowl*	*Gallus gallus*	c, R	W
4	Kalij Pheasant*	*Lophura leucomelanos*	uc, R	W
5	Grey Peacock Pheasant*	*Polyplectron bicalcaratum*	r, R	T, RK?
	ORDER: ANSERIFORMES **Family: Dendrocygnidae**			
6	Lesser Whistling-duck	*Dendrocygna javanica*	c, R	T, RK, C
	Family: Anatidae			
7	Cotton Pygmy-goose	*Nettapus coromandelianus*	r, R	T
	ORDER: PICIFORMES **Family: Picidae**			
8	Eurasian Wryneck	*Jynx torquila*	uc, M	W
9	White-browed Piculet*Ψ	*Sasia ochracea*	r, R	S
10	Rufous Woodpecker	*Celeus brachyurus*	c, R	W
11	Great Slaty Woodpecker*	*Mulleripicus pulverulentus*	r, R	T, C
12	Grey-capped Pygmy Woodpecker*	*Dendrocopos canicapillus*	r, R	W
13	Fulvous-breasted Woodpecker	*Dendrocopos macei*	vc, R	W
14	Greater Yellownape*	*Picus flavinucha*	c, R	W
15	Streak-throated Woodpecker	*Picus xanthopygaeus*	r, R	L, S, RK
16	Grey-headed Woodpecker	*Picus canus*	r, R	L, S
17	Black-rumped Flameback	*Dinopium benghalense*	vc, R	W
18	Greater Flameback*	*Chrysocolaptes lucidus*	vc, R	W
	Family: Megalaimidae			
19	Lineated Barbet	*Megalaima lineata*	vc, R	W
20	Blue-throated Barbet	*Megalaima asiatica*	vc, R	W
21	Blue-eared Barbet*	*Megalaima australis*	uc, R	L, S, RK, T
22	Coppersmith barbet	*Megalaima haemacephala*	vc, R	W
	ORDER: BUCEROTIFORMES **Family: Bucerotidae**			

23	Oriental Pied Hornbill*	*Anthracoceros albirostris*	uc, R	L, S, RK, T
	ORDER: UPUPIFORMES **Family: Upupidae**			
24	Common Hoopoe	*Upupa epops*	c, R	W
	ORDER: TROGONIFORMES **Family: Trogonidae**			
25	Red-headed Trogon*	*Harpactes erythrocephalus*	r, R	L, S, RK, T
	ORDER: CORACIIFORMES **Family: Coraciidae**			
26	Indian Roller	*Coracias benghalensis*	vc, R	W
27	Dollarbird*	*Eurystomus orientalis*	r, R	W
	Family: Alcedinidae			
28	Common Kingfisher	*Alcedo atthis*	c, R	W
29	Oriental Dwarf Kingfisher	*Ceyx erithacus*	r, R	L
	Family: Halcyonidae			
30	White-throated Kingfisher	*Halcyon smyrnensis*	c, R	W
	Family: Cerylidae			
31	Pied Kingfisher	*Ceryle rudis*	r, R	T
	Family: Meropidae			
32	Blue-bearded Bee-eater*	*Nyctyornis athertoni*	r, R	W
33	Green Bee-eater	*Merops orientalis*	vc, R	W
34	Blue-tailed Bee-eater*	*Merops philippinus*	c, R	W
35	Chestnut-headed Bee-eater*	*Merops leschenaulti*	vc, R	W
	ORDER: CUCULIFORMES **Family: Cuculidae**			
36	Pied Cuckoo	*Clamator jacobinus*	r, Rm	W
37	Common Hawk Cuckoo	*Hierococcyx varius*	vc, R	W
38	Indian Cuckoo	*Cuculus micropterus*	c, Rm	W
39	Plaintive Cuckoo	*Cacomantis merulinus*	c, Rm	W
40	Asian Emerald Cuckoo*	*Chrysococcyx maculatus*	r, Rm	S
41	Violet Cuckoo*	*Chrysococcyx xanthorhynchus*	r, R	S
42	Drongo Cuckoo*	*Surniculus lugubris*	r, Rm	L, S, RK, T
43	Asian Koel	*Eudynamys scolopacea*	vc, R	W
44	Green-billed Malkoha*	*Phaenicophaeus tristis*	vc, R	W
	Family: Centropodidae			
45	Greater Coucal	*Centropus sinensis*	vc, R	W
46	Lesser Coucal*	*Centropus bengalensis*	c, R	W
	ORDER: PSITTACIFORMES **Family: Psittacidae**			
47	Vernal Hanging Parrot*	*Loriculus vernalis*	r, R	L, S, RK, T
48	Rose-ringed Parakeet	*Psittacula krameri*	vc, R	W
49	Grey-headed Parakeet*	*Psittacula finschii*	r, R	L, S, RK
50	Blossom-headed Parakeet*	*Psittacula roseata*	r, R	L, S, RK
51	Red-breasted Parakeet*	*Psittacula alexandri*	vc, R	W
	ORDER: APODIFORMES **Family: Apodidae**			
52	Asian Palm Swift	*Cypsiurus balasiensis*	c, R	W
53	Fork-tailed Swift*	*Apus pacificus*	r, M	T
	ORDER: STRIGIFORMES **Family: Strigidae**			
54	Oriental Scops Owl*	*Otus sunia*	r, R	L, S, RK
55	Collared Scops Owl	*Otus bakkamoena*	r, R	W
56	Spot-bellied Eagle Owl*Ψ	*Bubo nipalensis*	r, R	T

57	Dusky Eagle Owl	*Bubo coromandus*	r, R	RK
58	Brown Fish Owl	*Ketupa zeylonensis*	r, R	W
59	Tawny Fish Owl*	*Ketupa flavipes*	r, R	RK, T
60	Asian Barred Owlet*	*Glaucidium cuculoides*	c, R	W
61	Spotted Owlet	*Athene brama*	vc, R	W
62	Brown Hawk Owl	*Ninox scutulata*	c, R	W
	Family: Caprimulgidae			
63	Large-tailed nightjar*	*Caprimulgus macrurus*	c, R	W
	ORDER: COLUMBIFORMES **Family: Columbidae**			
64	Rock Pigeon	*Columba livia*	c, R	W
65	Green Imperial Pigeon*	*Ducula aenea*	r, R	L, S, RK
66	Oriental Turtle Dove*	*Streptopelia orientalis*	r, Rm	L, S, RK
67	Spotted Dove	*Streptopelia chinensis*	vc, R	W
68	Red Collared Dove	*Streptopelia tranquebarica*	c, R	W
69	Eurasian Collared Dove	*Streptopelia decaocto*	c, R	W
70	Barred Cuckoo Dove*	*Macropygia unchall*	r, R	S
71	Emerald Dove*	*Chalcophaps indica*	c, R	W
72	Orange-breasted Green Pigeon*	*Treron bicincta*	r, R	L, S, RK
73	Pompadour Green Pigeon*	*Treron pompadora*	c, R	W
74	Thick-billed Green Pigeon*	*Treron curvirostra*	r, R	L, S, RK
75	Yellow-footed Green Pigeon	*Treron phoenicoptera*	c, R	W
76	Wedge-tailed Green Pigeon*	*Treron sphenura*	r, R	L, S, RK
	ORDER: GRUIFORMES **Family: Rallidae**			
77	White-breasted Waterhen	*Amaurornis phoenicurus*	uc, R	W
	ORDER: CICONIIFORMES **Family: Scolopacidae**			
78	Pintail Snipe	*Gallinago stenura*	r, M	W
79	Common Snipe	*Gallinago gallinago*	r, M	W
80	Green Sandpiper	*Tringa ochropus*	r, M	W
81	Wood Sandpiper	*Tringa glareola*	c, M	W
82	Common Sandpiper	*Actitis hypoleucos*	c, M	W
	Family: Rostratulidae			
83	Greater Painted Snipe	*Rostratula benghalensis*	uc, R	W
	Family: Jacanidae			
84	Bronze-winged Jacana	*Metopidius indicus*	uc, R	W
	Family: Charadriidae			
85	Little Ringed Plover	*Charadrius dubius*	r, M	RK, C, T
86	Red-wattled Lapwing	*Vanellus indicus*	uc, R	W
	Family: Glareoliday			
87	Small Pratincole	*Glareola lactea*	r, R	T
	Family: Laridae			
88	River Tern	*Sterna aurantia*	uc, R	T
89	Little Tern	*Sterna albifrons*	uc, R	T
	Family: Accipitridae			
90	Osprey	*Pandion haliaetus*	r, M	T
91	Black Baza*	*Aviceda leuphotes*	uc, Rm	L, S, RK, T
92	Black-shouldered Kite	*Elanus caeruleus*	uc, R	W
93	Black Kite	*Milvus migrans*	uc, R	W
94	Brahminy Kite	*Haliastur indus*	c, R	W
95	White-rumped Vulture	*Gyps bengalensis*	uc, R	RK, C, T
96	Eurasian Griffon	*Gyps fulvous*	r, Rm	RK

97	Crested Serpent Eagle*	*Spilornis cheela*	c, R	W
98	Shikra*	*Accipiter badius*	uc, R	W
99	Besra*Ψ	*Accipiter virgatus*	uc, R	W
100	Changeable Hawk Eagle*	*Spizaetus cirrhatus*	r, R	L, S, RK
	Family: Falconidae			
101	Common Kestrel*	*Falco tinnunculus*	uc, M	W
102	Amur Falcon*	*Falco amurensis*	r, M	L, RK
	Family: Phalacrocoracidae			
103	Little Cormorant	*Phalacrocorax niger*	r, R	T
	Family: Ardeidae			
104	Little Egret	*Egretta garzetta*	uc, R	W
105	Cattle Egret	*Bubulcus ibis*	uc, R	W
106	Indian Pond Heron	*Ardeola grayii*	vc, R	W
107	Black-crowned Night Heron	*Nycticorax nycticorax*	r, R	RK, C, T
108	Yellow Bittern	*Ixobrychus sinensis*	r, R	T
109	Cinnamon Bittern	*Ixobrychus cinnamomeus*	uc, R	RK, C, T
	Order: Ciconiidae			
110	Asian Openbill	*Anastomus oscitans*	r, R	RK
	ORDER: PASSERIFORMES			
	Family: Pittidae			
111	Blue-naped Pitta*	*Pitta nipalensis*	r, R	T
112	Hooded Pitta*	*Pitta sordida*	r, Rm	L, S, RK
	Family: Irenidae			
113	Asian Fairy Bluebird*	*Irena puella*	c, R	L, S, RK, T
114	Blue-winged Leafbird*	*Chloropsis cochinchinensis*	r, R	L, T
115	Golden-fronted Leafbird	*Chloropsis aurifrons*	vc, R	W
	Family: Laniidae			
116	Brown Shrike	*Lanius cristatus*	c, M	W
117	Long-tailed Shrike	*Lanius schach*	c, R	W
	Family: Corvidae			
118	Common Green Magpie*	*Cissa chinensis*	r, R	S, T
119	Rufous Treepie	*Dendrocitta vagabunda*	c, R	W
120	Grey Treepie*	*Dendrocitta formosae*	uc, R	W
121	House Crow	*Corvus splendens*	uc, R	C, T
122	Large-billed Crow	*Corvus macrorhynchos*	uc, R	W
123	Ashy Woodswallow	*Artamus fuscus*	uc, R	W
124	Black-naped Oriole*	*Oriolus chinensis*	r, M	RK
125	Black-hooded Oriole	*Oriolus xanthornus*	vc, R	W
126	Maroon Oriole*	*Oriolus traillii*	r, R	L
127	Large Cuckooshrike	*Coracina macei*	c, R	W
128	Black-winged Cuckooshrike*	*Coracina melaschistos*	r, M	L, S, RK
129	Black-headed Cuckooshrike	*Coracina melanoptera*	r, R	W
130	Rosy Minivet*	*Pericrocotus roseus*	r, R	L, S, RK
131	Ashy Minivet*	*Pericrocotus divaricatus*	r, R	L, S, RK
132	Small Minivet*	*Pericrocotus cinnamomeus*	vc, R	W
133	Scarlet Minivet*	*Pericrocotus flammeus*	c, R	W
134	Bar-winged Flycatcher-shrike*	*Hemipus picatus*	uc, R	L, S, RK
135	White-throated Fantail	*Rhipidura albicollis*	c, R	W
136	Black Drongo	*Dicrurus macrocercus*	vc, R	W
137	Ashy Drongo	*Dicrurus leucophaeus*	r, M	W
138	Bronzed Drongo*	*Dicrurus aeneus*	vc, R	W
139	Lesser Racket-tailed Drongo*	*Dicrurus remifer*	r, M	L, S, RK
140	Spangled Drongo*	*Dicrurus hottentottus*	c, R	W

141	Greater Racket-tailed Drongo*	*Dicrurus paradiseus*	c, R	W
142	Black-naped Monarch	*Hypothymis azurea*	c, R	W
143	Common Iora	*Aegithina tiphia*	vc, R	W
144	Large Woodshrike*	*Tephrodornis gularis*	c, R	L, S, RK
145	Common Woodshrike*	*Tephrodornis pondicerianus*	c, R	W
	Family: Muscicapidae			
146	Blue Rock Thrush	*Monticola solitarius*	uc, M	W
147	Blue Whistling Thrush*	*Myophonus caeruleus*	r, R	T
148	Orange-headed Thrush	*Zoothera citrina*	r, R	W
149	Red-throated Flycatcher	*Ficedula parva*	vc, M	W
150	Verditer Flycatcher*	*Eumyias thalassina*	uc, M	W
151	Pale-chinned Flycatcher*	*Cyornis poliogenys*	r, R	RK
152	Grey-headed Canary Flycatcher	*Culicicapa ceylonensis*	c, R	W
153	Oriental Magpie Robin	*Copsychus saularis*	vc, R	W
154	White-rumped Shama*	*Copsychus malabaricus*	c, R	W
155	Black Redstart	*Phoenicurus ochruros*	r, M	W
156	Black-backed Forktail*	*Enicurus immaculatus*	r, R	L, S, RK, T
157	Common Stonechat	*Saxicola torquata*	c, M	W
158	Pied Bushchat	*Saxicola caprata*	r, R	C, T
	Family: Sturnidae			
159	Asian Glossy Starling	*Aplonis panayensis*	r, M	T
160	Chestnut-tailed Starling	*Sturnus malabaricus*	vc, R	W
161	Asian Pied Starling	*Sturnus contra*	vc, R	W
162	Common Myna	*Acridotheres tristis*	vc, R	W
163	Bank Myna	*Acridotheres ginginianus*	r, R	W
164	Jungle Myna	*Acridotheres fuscus*	vc, R	W
165	Hill Myna*	*Gracula religiosa*	c, R	W
	Family: Sittidae			
166	Velvet-fronted Nuthatch*	*Sitta frontalis*	r, R	RK
	Family: Paridae			
167	Great Tit	*Parus major*	vc, R	W
	Family: Hirundinidae			
168	Barn Swallow	*Hirundo rustica*	c, M	W
	Family: Pycnonotidae			
169	Black-headed Bulbul*	*Pycnonotus atriceps*	uc, R	W
170	Black-crested Bulbul*	*Pycnonotus melanicterus*	c, R	W
171	Red-whiskered Bulbul	*Pycnonotus jocosus*	vc, R	W
172	Red-vented Bulbul	*Pycnonotus cafer*	vc, R	W
173	White-throated Bulbul*	*Alophoixus flaveolus*	c, R	W
174	Olive Bulbul*	*Lole virescens*	r, R	RK
	Family: Cisticolidae			
175	Grey-breasted Prinia	*Prinia hodgsonii*	c, R	W
176	Plain Prinia	*Prinia inornata*	uc, R	W
177	Zitting Cisticola	*Cisticola juncidis*	c, R	W
	Family: Zosteropidae			
178	Oriental White-eye	*Zosterops palpebrosus*	vc, R	W
	Family: Sylviidae			
179	Blyth's Reed Warbler	*Acrocephalus dumetorum*	c, M	W
180	Striated Grassbird	*Megalurus palustris*	uc, R	C, T
181	Mountain Tailorbird*	*Orthotomus cuculatus*	r, R	T
182	Common Tailorbird	*Orthotomus sutorius*	vc, R	W
183	Dark-necked Tailorbird*	*Orthotomus atrogularis*	uc, R	T, C
184	Common Chiffchaff	*Phylloscopus collybita*	uc, R	W

185	Yellow-browed Warbler*	*Phylloscopus inornatus*	c, M	W
186	Greenish Warbler*	*Phylloscopus trochiloides*	c, M	W
187	Blyth's Leaf Warbler	*Phylloscopus reguloides*	uc, M	L, S, RK
188	White-crested Laughingthrush*	*Garrulax leucolophus*	r, R	C
189	Greater Necklaced Laughingthrush*	*Garrulax pectoralis*	c, R	W
190	Rufous-necked Laughingthrush*	*Garrulax ruficollis*	uc, R	W
191	Abbott's Babbler*	*Malacocincla abbotti*	c, R	W
192	Spot-throated Babbler*	*Pellorneum albiventre*	r, R	L
193	Puff-throated Babbler*	*Pellorneum ruficeps*	c, R	W
194	Large Scimitar Babbler*	*Pomatorhinus hypoleucos*	r, R	T
195	White-browed Scimitar Babbler*	*Pomatorhinus schisticeps*	r, R	L, S, RK
196	Grey-throated Babbler*	*Stachyris nigriceps*	r, R	C
197	Striped Tit Babbler*	*Macronous gularis*	c, R	W
198	Chestnut-capped Babbler*	*Timalia pileata*	r, R	C
	Family: Alaudidae			
199	Indian Bushlark	*Mirafra erythroptera*	r, R	C, T
200	Rufous-winged Bushlark	*Mirafra assamica*	c, R	W
	Family: Nectariniidae			
201	Thick-billed Flowerpecker	*Dicaeum agile*	uc, R	W
202	Orange-bellied Flowerpecker*	*Dicaeum trigonostigma*	r, R	T
203	Pale-billed Flowerpecker	*Dicaeum erythrorynchos*	c, R	W
204	Scarlet-backed Flowerpecker*	*Dicaeum cruentatum*	c, R	W
205	Ruby-cheeked Sunbird*	*Anthreptes singalensis*	uc, R	W
206	Purple-rumped Sunbird	*Nectarinia zeylonica*	uc, R	W
207	Purple-throated Sunbird*	*Nectarinia sperata*	c, R	W
208	Purple Sunbird	*Nectarinia asiatica*	vc, R	W
209	Crimson Sunbird*	*Aethopyga siparaja*	c, R	W
210	Little Spiderhunter*	*Arachnothera longirostra*	vc, R	W
	Family: Passeridae			
211	House Sparrow	*Passer domesticus*	c, R	W
212	Forest Wagtail*	*Dendronanthus indicus*	uc, M	W
213	White Wagtail	*Motacilla alba*	c, M	W
214	White-browed Wagtail	*Motacilla maderaspatensis*	c, R	W
215	Citrine Wagtail	*Motacilla citreola*	r, M	W
216	Yellow Wagtail	*Motacilla flava*	uc, M	W
217	Grey Wagtail	*Motacilla cinerea*	uc, M	W
218	Paddyfield Pipit	*Anthus ruficollis*	c, R	W
219	Olive-backed Pipit*	*Anthus hodgsoni*	c, M	W
220	Red-throated Pipit	*Anthus cervinus*	r, M	RK
221	Baya Weaver	*Ploceus philippinus*	c, R	W
222	Indian Silverbill	*Lonchura malabarica*	r, R	W
223	White-rumped Munia	*Lonchura striata*	uc, R	W
224	Scaly-breasted Munia	*Lonchura punctulata*	c, R	W
225	Black-headed Munia	*Lonchura malacca*	r, R	W

* Primarily forest species.

Ψ Recorded in the third year's survey (2007).

4.3 Important Observations in the Field

The rare birds observed for the first time during this year's (2007) survey are White-browed Piculet, Spot-bellied Eagle Owl and Besra. 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, some rare nests were seen this year, which were of Blue-eared Barbet, Greater Racket-tailed Drongo, Scarlet Minivet, Chestnut-capped Babbler, Ruby-cheeked Sunbird, Purple-throated Sunbird and Little Spiderhunter.

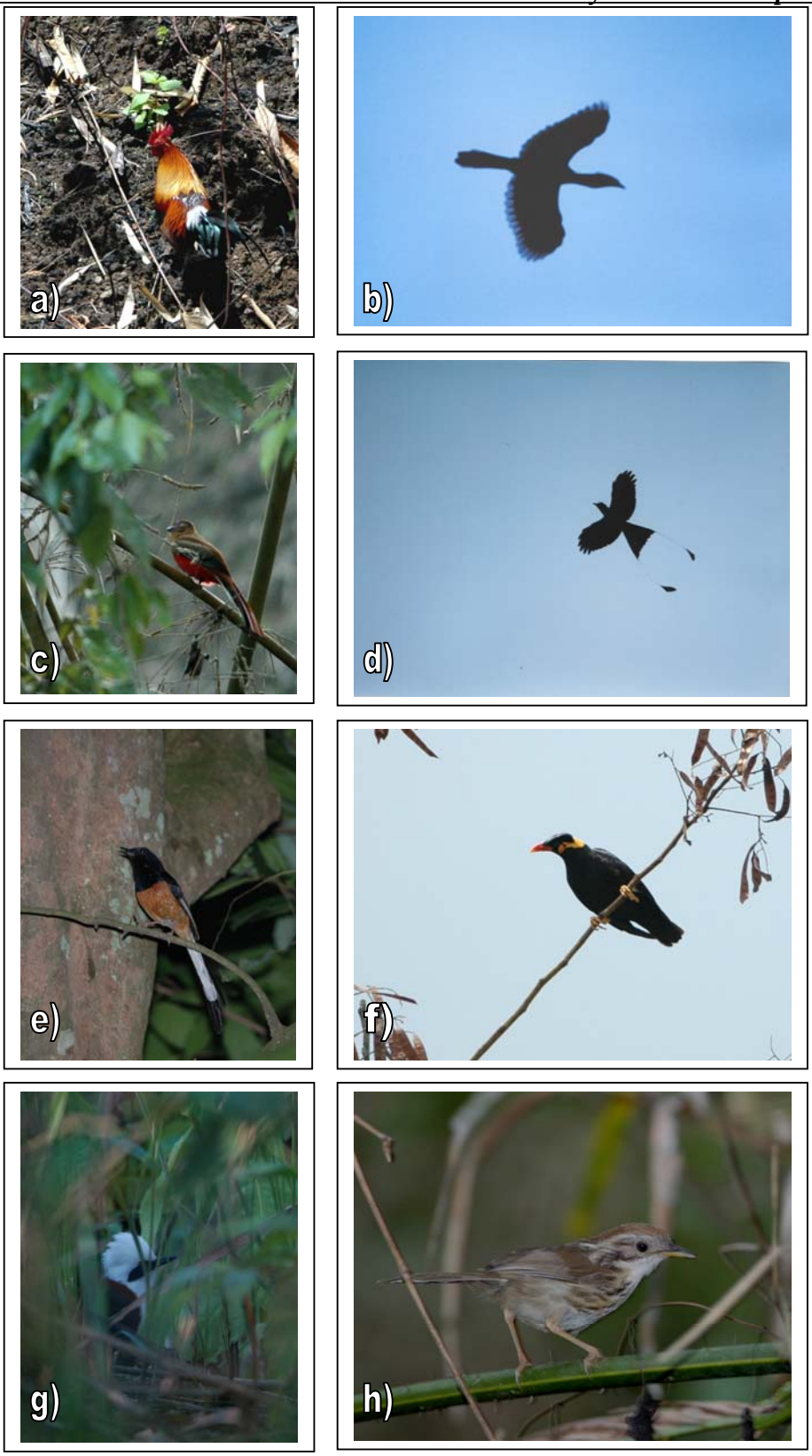
Other than the birds, some other important wildlife species were observed in the field. These include a number of rare amphibians and reptiles of which a tree frog and a gecko were new records for Bangladesh, Green Fan-throated Lizard (*Ptyctolaemus gularis*), Khasi Hills Long-tailed Lizard (*Takydromus khasiensis*), White-lipped Pit Viper (*Trimeresurus albolabris*), Blyth's Horse-shoe Bat (*Rhinolophus lepidus*) and Masked Palm Civet (*Paguma larvata*). Moreover, a nationally threatened species of flowering plant (*Hedychium coccineum*) (Khan *et al.* 2001) was found abundant in a grassy hill slope on the way to Satchori.

4.4 Threats to the Birds and Their Habitats

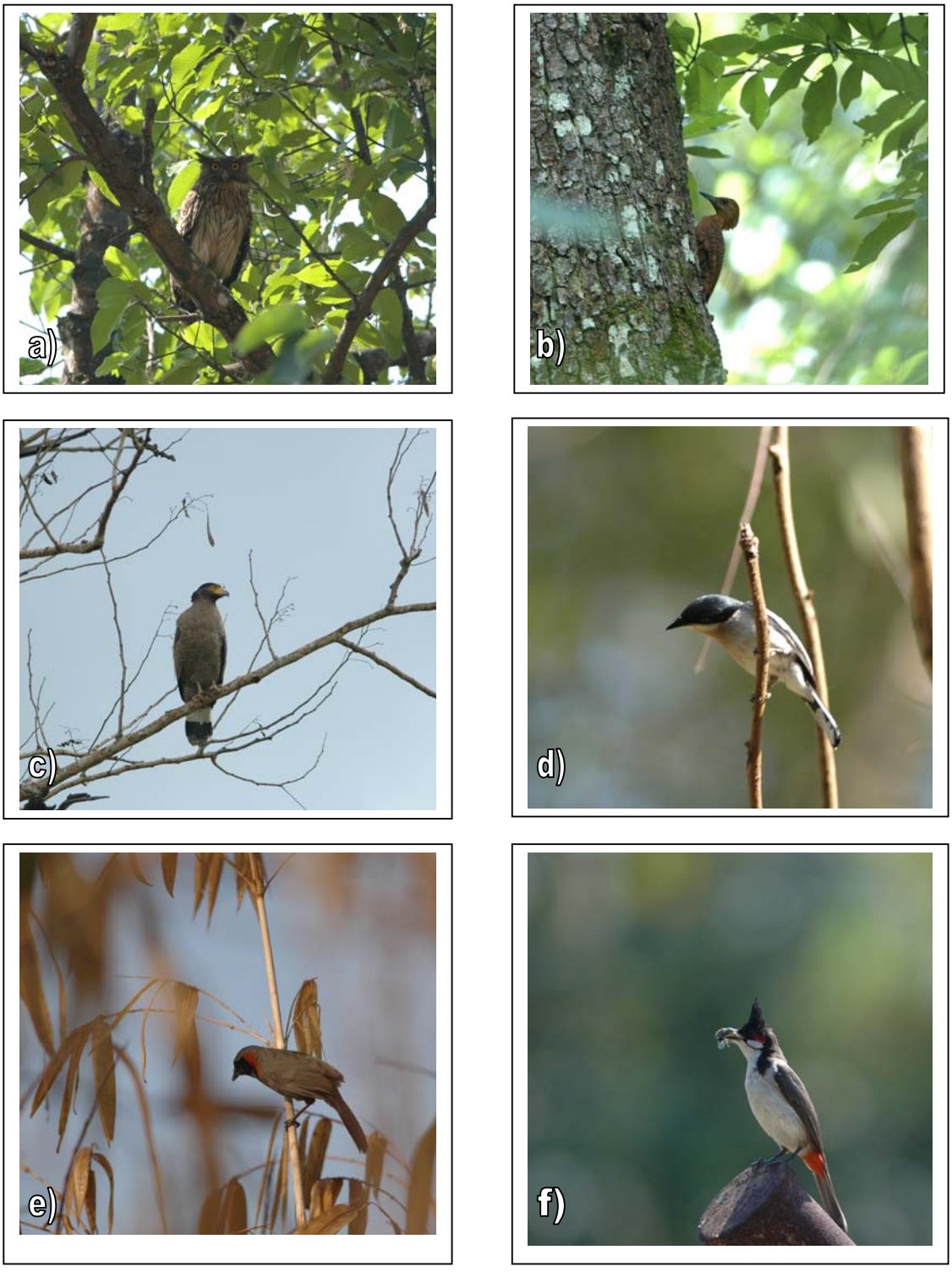
Habitat loss remains as the main threat to the birds in all the five NSP sites. Like in the two previous years, illegal felling of trees and bamboo and conversion of natural forests to monoculture plantations and agricultural fields were witnessed during this year's survey (2007). The natural forest patches that we observed In the Toynga Hill and Kudum areas of Teknaf during our first year's (2005) survey have been destroyed very badly in just three years. Steps should be taken urgently to preserve the remnants of the natural forests in Teknaf. In Lawachara, Satchori and Rema-Kalenga, there was no sign of large-scale deterioration of the forests, and to some parts, the forest condition has been improved in these three sites. The excessive number of visitors, particularly in Lawachara, Satchori and Teknaf, is another serious threat to the wilderness of those areas.

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. Moreover, large-scale illegal harvest of forest fruits, particularly 'chapalish' (*Artocarpus chaplasha*) and 'latkan' (*Bixa* sp.), is a growing threat to the frugivorous birds and mammals.

NSP should focus on reducing the above-mentioned threats. Despite tremendous efforts, the rate of loss of tree cover is still very alarming in some areas, together with the conversion of lands. 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. Depending on the capacity of the area the number of visitors to the NSP sites must be controlled. 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 wider dimension. 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 for even longer period of time. The participatory bird survey should be repeated on an annual basis, at least 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.



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 indicators: a) Brown Fish Owl, b) Rufous Woodpecker, c) Crested Serpent Eagle, d) Bar-winged Flycatcher-shrike, e) Rufous-necked Laughingthrush, and f) Red-whiskered Bulbul

Threats to the birds and their habitats: a) illegal logging in Teknaf, b) pollution in Lawachara as a result of too many visitors at a time, and c) hill-cutting for supplying soil in the brick field in Chunati

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APPENDICES

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

Nishorgo Support Project (NSP)

Participatory Bird Survey
to Assess Protected Area Management Impacts

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 in 2007

Team Leader

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15) ***Bacha Miah***, Chunati, Chittagong.
16) ***Md. Sohel Ahmed***, Chunati, Chittagong.
17) ***Kironmoy Chakma***, Teknaf, Cox's Bazar.
18) ***Vijay Chakma***, Teknaf, Cox's Bazar.