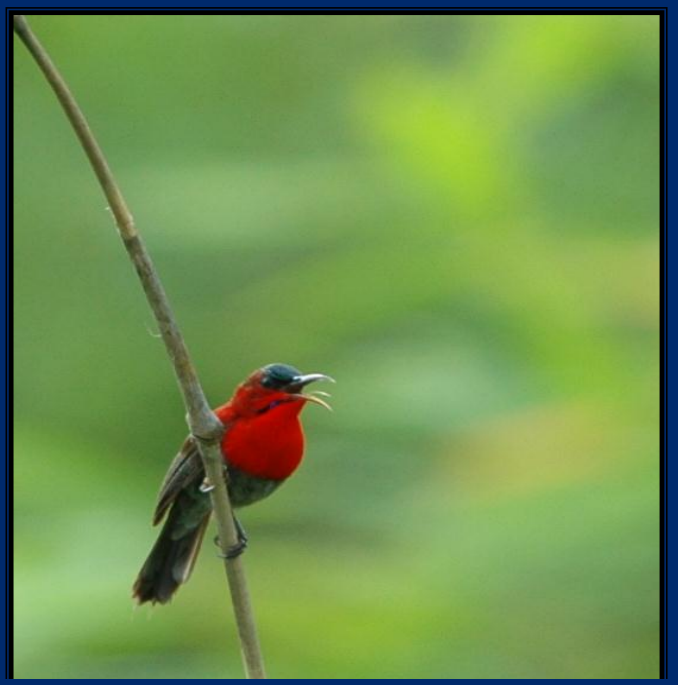
USAID
FROM THE AMERICAN PEOPLE

ipac

INTEGRATED PROTECTED AREA CO-MANAGEMENT (IPAC)

PARTICIPATORY BIRD MONITORING TO ASSESS THE MANAGEMENT IMPACTS IN INTEGRATED PROTECTED AREA CO-MANAGEMENT SITES: FOURTH YEAR REPORT



October 22, 2012

This report was produced for review by the United States Agency for International Development (USAID).

Cover Photo:
Indicator birds are resident forest birds identified as proxy indicators set to portray biophysical changes in forest ecosystem with the advent of co-management approach in 10 forest protected areas. This measure has been incorporated in the design of IPAC under custom indicator 15:- "increase in the density of indicator bird species in wetlands and forested landscapes". The cover photo is of Crimson Sunbird (*Aethopyga siparaja*) an indicator species selected for five forest PAs covered in the study (Khadimnagar NP, Modhupur NP, Kaptai NP, Fasiakhali WS and Medakachapia NP).

INTEGRATED PROTECTED AREA CO-MANAGEMENT (IPAC)

PARTICIPATORY BIRD MONITORING TO ASSESS THE MANAGEMENT IMPACTS IN INTEGRATED PROTECTED AREA CO-MANAGEMENT SITES: FOURTH YEAR REPORT

USAID Contract N° EPP-1-00-06-00007-00

Task Order No: EPP-I-01-06-00007-00

October 22, 2012

Submitted to:
USAID/Bangladesh

Submitted By:

M. Monirul H. Khan, PhD
Associate Professor of Zoology
Jahangirnagar University
Savar, Dhaka 1342, Bangladesh
E-mail: mmhkhan@hotmail.com

International Resources Group (IRG)
With subcontractors:
WWF-USA, dTS, East-West Center
Environmental Law Institute, Epler-Wood International
The WorldFish Center, CNRS, CODEC
BELA, Asiatic M&C, Oasis Transformation, Module Architects, IUB/JU

CONTENTS

SUMMARY

Integrated Protected Area Co-management (IPAC) is a project of the Bangladesh Forest Department, which is being implemented by International Resources Group (IRG) with its local partners, and it is funded by the United States Agency for International Development (USAID). Participatory bird monitoring was taken as the tool to assess the co-management impacts in IPAC sites. Strip-transect sampling and opportunistic survey methods were followed in the field. This year (March-August 2012; c. 50 observation-days in the field) the monitoring was conducted in five priority 'New Direct' sites (Kaptai, Fasiakhali, Medakachapia, Khadimnagar and Madhupur) and five priority 'Existing Direct' sites (Lawachara, Satchari, Rema-Kalenga, Chunati and Teknaf), and the results were compared with those of previous years.

Red Junglefowl (*Gallus gallus*) showed the tendency of increasing density in all the ten sites. In five New Direct sites the increase was 9.5-34.6% and in five Existing Direct sites the increase was 60.3-180.6% from the first year (2009 and 2005, respectively) of monitoring. Puff-throated Babbler (*Pellorneum ruficeps*) also showed the tendency of increasing density in most of the ten sites, especially in five Existing Direct sites. In five New Direct sites the increase was 3.1-8.5% and in five Existing Direct sites the increase was 33.9-103.1% from the first year of monitoring. Abbott's Babbler (*Malacocincla abbotti*), which was monitored only in four of five New Direct sites, weakly showed the tendency of increasing density (1.7-4.9%).

Hill Myna (*Gracula religiosa*) showed the tendency of decreasing density in all the ten sites. In five New Direct sites the decrease was 0-10.5% and in five Existing Direct sites the decrease was 3.3-11.8% from the first year of monitoring. Oriental Pied Hornbill (*Anthracoceros albirostris*), which was monitored only in five Existing Direct sites, also showed the tendency of decreasing density (35.3-60.2%). The densities of other indicator species of birds remained more or less stable in all sites.

Increase of the densities of three species of indicator birds (Red Junglefowl, Puff-throated Babbler and Abbott's Babbler) of the lower storey indicates an improvement of undergrowths and bushes, and regeneration of forests, which caused the increment of the carrying capacity and nesting sites for these three species. The community patrolling, alternative income generation, awareness and other programs by IPAC have played the key role in reducing the clearing of understorey vegetation for firewood as well as reducing the hunting pressure. This, 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, it appears that some illegal logging of selective timber trees and encroachment of forest land mainly for agricultural (particularly in Teknaf and Rema-Kalenga) still persist, which probably caused the decline of two indicator bird species (Hill Myna and Oriental Pied Hornbill) of the upper storey.

The total bird species recorded in five New Direct sites (249), or in five Existing Direct sites (239) in a limited period of time (in rainy season) in a few years represents over 30% of the birds recorded in Bangladesh. A relatively high ratio of rare birds (37% and 35%, respectively) emphasizes the need of continuous monitoring of birds and the immediate need of improving the ecological condition of these areas.

1. INTRODUCTION

Biological indicators are used in many ways to understand the change in their surroundings, which is reflected by the change in number or behavior of the indicator species. Determination of the extent to which ecological systems are experiencing changes is critical for long-term conservation of biotic diversity in the face of changing landscapes and land use (Canterbury *et al.* 2000). Scientists are successfully using birds as indicators of the ecological changes (Johnston 1956, Morrison 1986, Canterbury *et al.* 2000, Browder *et al.* 2002), because they are relatively more visible, fast-breeder and more responsive to any change in their habitat. Systematic monitoring of the trend of change in the population density of habitat-specific birds reveals the trend of health of their habitats. The primary assumption is that the population density of a habitat-specific bird will increase, remain unchanged or decrease if that particular habitat improves, remains unchanged or degrades. The indicator species of birds must be habitat-specific, i.e. the species that will not survive outside a particular habitat type. It is advised that several species of indicators should be taken so that they represent different strata and different ecological niches of the area to be monitored.

Bangladesh is exceptionally rich in avifaunal diversity and abundance. Not only is the avifauna, the country 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, Siddiqui *et al.* (2008) mentioned the occurrence of 650 species of birds in Bangladesh, and Khan (2008a) mentioned the occurrence of 690 species including 380 residents, 209 winter visitors, 11 summer visitors, and 90 vagrants. This can be compared with the total number of bird species in the whole of Europe, or the United Sates, which include much larger area. 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 forests, wetlands and other wilderness areas of the country are under tremendous pressure of overexploitation, together with improper management. People living around the natural forests and wetlands are largely dependant on the natural resources. Some people almost entirely subsist on the harvest of the timber, bamboo and other forest products, or fish. The rate of forest loss in Bangladesh has been 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). Bangladesh has less than 0.02 ha of forest land per person – one of the lowest forest to population ratios in the world. On the other hand, large areas of wetlands have been converted to agricultural lands and fish firms.

The urgent need to conserve the remaining natural habitats, together with the biodiversity that these areas support, while developing non-consumptive uses at the same time, gave rise to a unique project, i.e. Nishorgo Support Project (NSP), in 2004. This five-year project was followed by a similar, but more extensive project, i.e. Integrated Protected Area Co-management (IPAC), which covered a total of 25 sites including 5 NSP sites. The project belongs to the Bangladesh Forest Department (FD), Ministry of Environment and Forests, Government of Bangladesh, which is financially supported by the United States Agency for International Development (USAID). The implementing agency of this project is International Resources Group (IRG), with its local partners. The project aims at improving the condition of some forests and wetlands, including the biodiversity, with active participation of the local communities. This will eventually develop a co-management system involving the local communities with the Forest Department.

IPAC requires an assessment of the impact of co-management activities that are being done. Systematic annual monitoring of the population densities of some selected indicator birds, together with an assessment of overall species diversity of birds, came as the most convenient and useful tool. This is also a way to enrich our knowledge and understanding of birds living in the IPAC sites. Since the fundamental policy of IPAC is to adopt a participatory approach, the bird monitoring followed the

same, involving the people living around the monitoring sites, Forest Department officials and research students. The participatory bird monitoring had the following objectives –

- Monitor the population densities of indicator birds on an annual basis and interprete the results to understand the management impacts in IPAC sites.
- Record the principal diet, principal foraging guild, status and distribution of all the species of birds occur in selected IPAC sites and gather information on the threatened species of birds.
- Train the participants of the monitoring team on survey method and identification of birds, so that they can continue the monitoring after the completion of the project.
- Raise awareness of the general public, especially the stakeholders living around the IPAC sites, to the status of birds and the importance of conservation.

2. PROJECT SITES

A total of 25 forest and wetland sites are included in IPAC under five clusters that are situated in different parts of Bangladesh except the northwest. Among these sites five (Lawachara, Satchari, Rema-Kalenga, Chunati and Teknaf) were under NSP as well.

Geographically, Bangladesh is situated 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 km², where about 160 million people live. This is one of the most densely populated countries in the world. The bigger part of Bangladesh (86%) is composed of floodplains and the rest are hills and highlands. The climate of Bangladesh is tropical monsoon, characterized 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.

One-tenth (9.8% or 1.45 million ha) of Bangladesh's surface area is under the forest belts (Bangladesh Forest Department and Bangladesh Space Research and Remote Sensing Organization 2008), but the actual coverage of natural forests is less than this, with most of this accounted for by the Sundarbans mangrove forest. There are three classes of natural forests in Bangladesh: i) mangrove forests – situated in the southwest, ii) mixed-evergreen forests – situated in the northeast and southeast, and iii) deciduous forests – situated in the central, northern and northwestern regions of the country. There are 31 [15 National Parks (NP) and 16 Wildlife Sanctuaries (WS); declared under Bangladesh Wildlife Act] official Protected Areas in Bangladesh, mostly in the forested areas, with a total area of 872,957 ha, covering only 5.9% of the total area of Bangladesh.

Bangladesh is a country of wetlands, with 7% (1.03 million ha) of the country permanently always under water, 21% (3.09 million ha) deeply flooded and 35% (5.16 million ha) experiencing shallow inundation during the wet season.

The country has a rich biological heritage as a consequence of its location at the confluence of the two major biotic subregions – the Indo-Himalayas and Indo-China (MacKinnon and MacKinnon 1986). A total of 121 species of mammals, 690 birds, 158 reptiles and 53 amphibians are expected to occur in Bangladesh (Khan 2008a).

Table 1. Protected Areas (National Parks – NP and Wildlife Sanctuaries – WS) and other conservation sites under IPAC. Areas where indicator bird monitoring was carried out have shown in yellow (five New Direct sites) and blue (five Existing Direct sites) shades

Sl. No.	Name of Area	Type of Area	Location (District)	Total Area (ha)	Implementation Strategy*
	Sylhet Cluster				
1	Lawachara NP	Mixed-evergreen forest in hillocks	Moulvibazar	1,250	Existing Direct
2	Satchari NP	Mixed-evergreen forest in hillocks	Habiganj	243	Existing Direct
3	Rema-Kalenga WS	Mixed-evergreen forest in hillocks	Habiganj	1,795	Existing Direct
4	Khadimnagar NP	Mixed-evergreen forest in hillocks	Sylhet	679	New Direct
5	Hail Haor	Freshwater wetland	Moulvibazar	13,000	Existing Direct
6	Tanguar Haor (Ecologically Critical Area/ Ramsar Site)	Freshwater wetland	Sunamganj	9,727	New Indirect
7	Hakaluki Haor (Ecologically Critical Area)	Freshwater wetland	Moulvibazar and Sylhet	18,383	New Indirect
	Central Cluster				
8	Madhupur NP	Deciduous forest in hillocks	Tangail and Mymensingh	8,436	New Direct
9	Bhawal NP	Deciduous forest in hillocks	Gazipur	5,022	New Indirect
10	Turag-Bangsi	River and floodplain	Gazipur and Tangail	10,000	Existing Direct
11	Kangsa-Malijhi	River and floodplain	Sherpur	8,000	Existing Direct
	Southeastern Cluster				
12	Teknaf WS	Mixed-evergreen forest and bamboo in hills	Cox's Bazar	11,615	Existing Direct
13	Teknaf Peninsula (Ecologically Critical Area)	Sea beach and hills	Cox's Bazar	10,465	New Indirect
14	Chunati WS	Bamboo in hills	Chittagong and Cox's Bazar	7,764	Existing Direct
15	Fashiakhali WS	Mixed-evergreen forest in hills	Cox's Bazar	1,302	New Direct
16	Medakachapia NP	Dipterocarp forest in hillocks	Cox's Bazar	396	New Direct
17	Himchari NP	Mixed evergreen forest in hills	Cox's Bazar	1,729	New Indirect
18	Inani (proposed NP)	Sea beach and hills	Cox's Bazar	7,700	New Indirect

Sl. No.	Name of Area	Type of Area	Location (District)	Total Area (ha)	Implementation Strategy*
	Chittagong Hill Tracts Cluster				
20	Kaptai NP	Mixed-evergreen forest in hills	Rangamati	5,464	New Direct
21	Dudpukuria-Dhopachari WS	Mixed-evergreen forest in hills	Chittagong	4,717	New Direct
	Sundarbans Cluster				
22	Sundarbans East WS (World Heritage Site/ Ramsar Site)	Mangrove forest in lowland coast	Bagerhat	31,226	New Direct
23	Sundarbans South WS (World Heritage Site/ Ramsar Site)	Mangrove forest in lowland coast	Khulna	36,970	New Indirect
24	Sundarbans West WS (World Heritage Site/ Ramsar Site)	Mangrove forest in lowland coast	Satkhira	71,502	New Indirect
25	Sundarbans (Ecologically Critical Area)	Mangrove forest in lowland coast and surrounding villages	Bagerhat, Khulna and Satkhira	59,600	New Indirect

* Note: Existing Direct – five sites that were under NSP and now under IPAC, New Direct – high priority sites of IPAC, and New Indirect – low priority sites of IPAC.

Although there are 25 sites under IPAC, the indicator bird monitoring was conducted in five of the priority New Direct sites (which was decided by IPAC) in 2009, 2010 and 2012. The sites are: i) Kaptai NP), ii) Fasiakhali WS, iii) Medakachapia NP, iv) Khadimnagar NP, and v) Madhupur NP, and in Existing Direct sites (i.e. NSP sites included in IPAC: i) Lawachara NP, ii) Satchari NP, iii) Rema-Kalenga WS, iv) Chunati WS, and v) Teknaf WS (previously Teknaf Game Reserve) (Table 1, Figure 1).

The bird monitoring transect locations and lengths of five New Direct sites and five Existing Direct sites are shown in Tables 2 and 3, respectively. The maps of five New Direct sites and five Existing Direct sites where bird monitoring was conducted are shown in Figures 2 and 3, respectively.

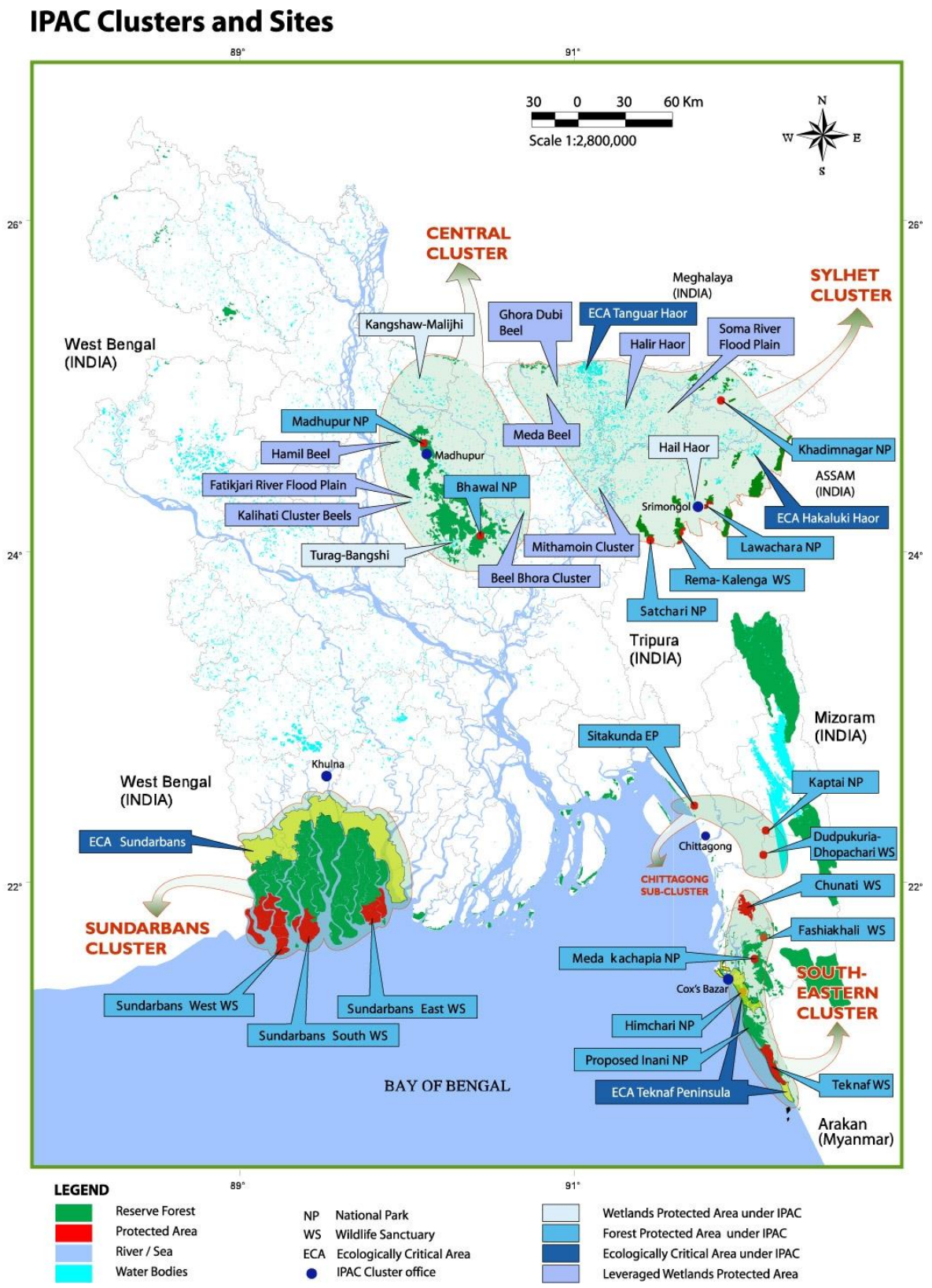


Figure 1. Bangladesh showing the locations of all sites of IPAC under five clusters.

Table 2. Strip transects in five priority New Direct sites of IPAC where the bird monitoring was conducted

Name of Project Site	Name of Transect	Location in Project Site	Geographic Locations of Two Ends	Landmarks at Two Ends	Length (km)
Kaptai National Park	Rampahar Stream	Northwest	22°29.709′ N, 92°11.123′ E; 22°30.469′ N, 92°10.440′ E	Balurchar, intersection	1.80
	Rampahar Hill	West	22°30.469′ N, 92°10.440′ E; 22°29.880′ N, 92°10.583′ E	Intersection, culvert	1.10
	Jamaichara	Southwest	22°29.668′ N, 92°10.683′ E; 22°29.345′ N, 92°10.752′ E	Karnaphuli south bank, narrow pass	0.61
	Rangamati Road	Centre	22°30.663′ N, 92°12.451′ E; 22°30.937′ N, 92°12.182′ E	Milestone, forest end	0.69
	Bangchari	Centre	22°30.040′ N, 92°11.697′ E; 22°31.576′ N, 92°11.138′ E	Main road, Debachari	3.00
Fasiakhali Wildlife Sanctuary	Lama Road	Centre	21°43.090′ N, 92°05.516′ E; 21°42.761′ N, 92°06.408′ E	Cox's Bazar Road, culvert	1.70
	Natunpahar East	West	21°42.338′ N, 92°04.765′ E; 21°42.369′ N, 92°05.315′ E	Natunpahar mosque, Garzanbunia	0.95
Medakachapia National Park	Medakachapia East	East	21°38.484′ N, 92°04.402′ E; 21°38.329′ N, 92°05.080′ E	Cox's Bazar road, Kurahari	1.20
	Medakachapia West	West	21°38.632′ N, 92°04.392′ E; 21°38.783′ N, 92°03.592′ E	Cox's Bazar Road, Kacchapia office	1.40
Khadimnagar National Park	Kalagool Road	West	24°57.248′ N, 91°56.311′ E; 24°56.673′ N, 91°55.689′ E	Khadimnagar office, Kalagool	1.50
	Khadimnagar Central	Centre	24°56.677′ N, 91°56.391′ E; 24°57.248′ N, 91°56.311′ E	South border, Khadimnagar office	1.10
	Choragang Road	East	24°57.248′ N, 91°56.311′ E; 24°56.975′ N, 91°57.198′ E	Hindur Jhiri, brick field	1.91
Madhupur National Park	Rasulpur	East	24°41.342′ N, 90°08.350′ E; 24°41.488′ N, 90°07.015′ E	Rasulpur office, Koia Pukur	2.30
	Jalui	East	24°41.342′ N, 90°08.350′ E; 24°40.779′ N, 90°07.683′ E	Rasulpur office, Jalui office	1.50
	Lahoria	Centre	24°41.730′ N, 90°06.283′ E; 24°41.631′ N, 90°05.760′ E	Lahoria office, west intersection	0.90
	Monar Bide	West	24°40.211′ N, 90°06.287′ E; 24°40.811′ N, 90°06.137′ E	Metalled road, Gaira	1.10

Table 3. Strip transects in five priority Existing Direct sites (i.e. NSP sites included in IPAC) where the bird monitoring was conducted

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
Satchari National Park	Satchari West	Central	24°07.5′ N, 91°26.7′ E; 24°06.6′ N, 91°27.2′ E	'Wilderness' signboard, teak plantation	1.94
	Satchari East	Central	24°07.6′ N, 91°27.0′ E; 24°07.3′ N, 91°27.2′ E	Sloppy passage, open grassland	0.56
	Satchari 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 Wildlife Sanctuary	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

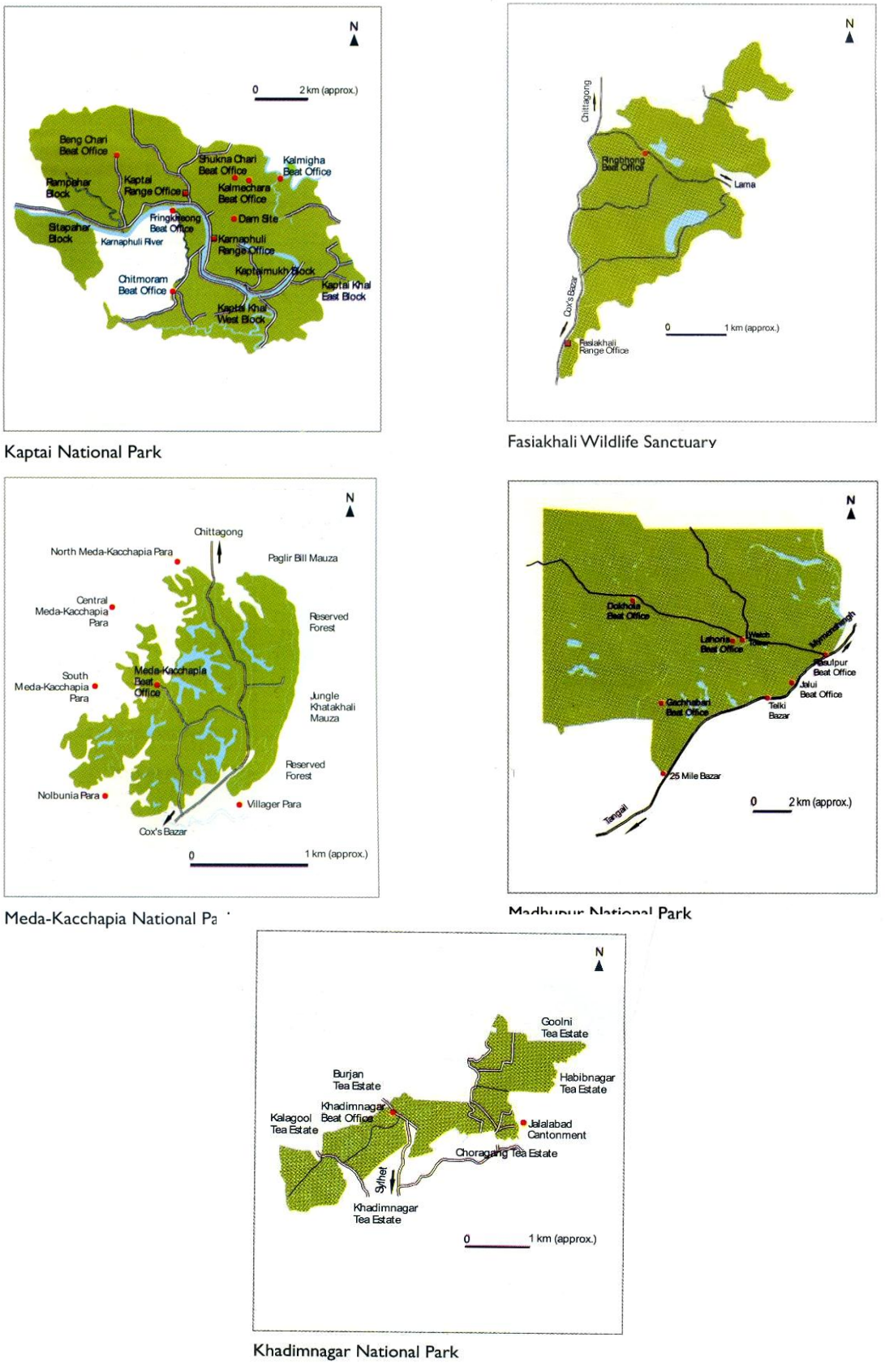
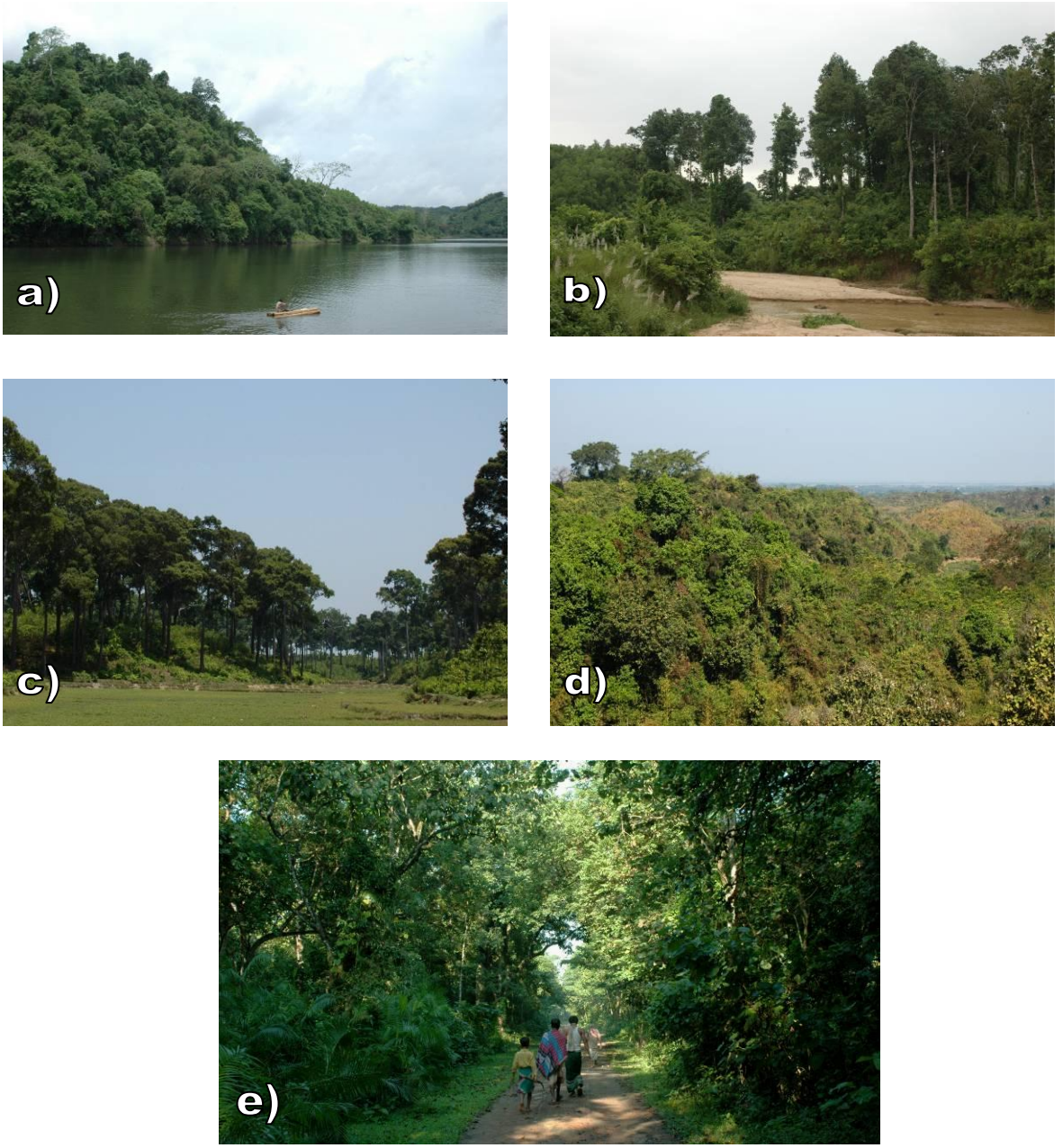
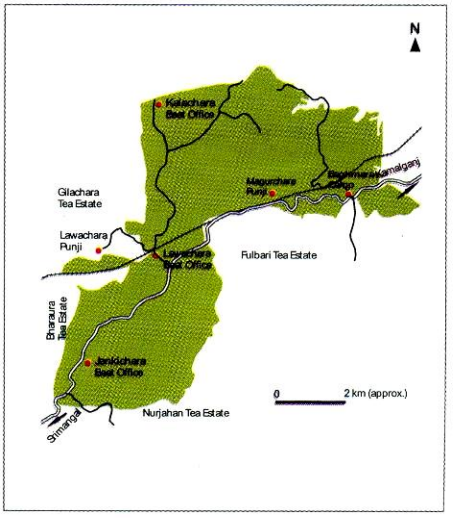


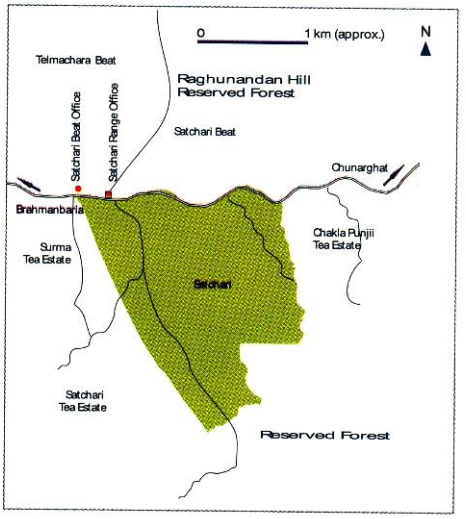
Figure 2. Five priority New Direct sites of IPAC where the bird monitoring was conducted.



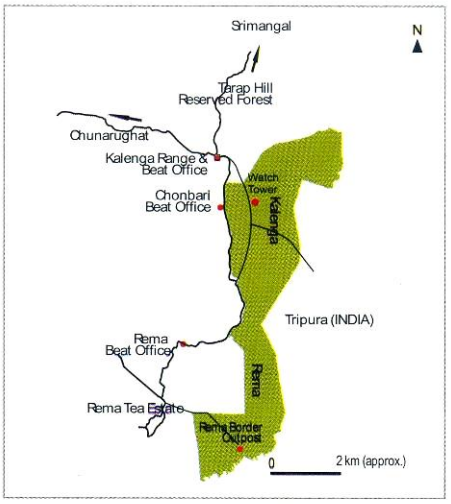
Views of five priority New Direct sites of IPAC where the bird monitoring was conducted: a) Kaptai NP, b) Fasiakhali WS, c) Medakachapia NP, d) Khadimnagar NP, and e) Madhupur NP.



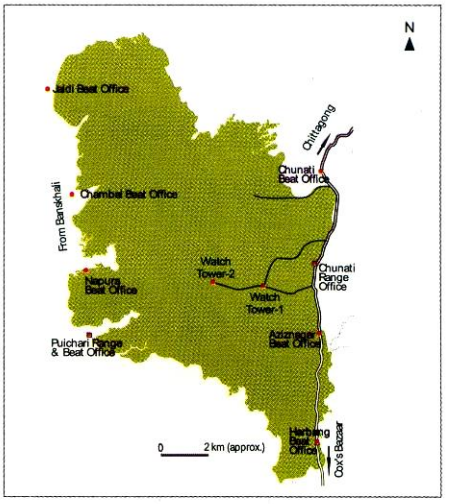
Lawachara National Park



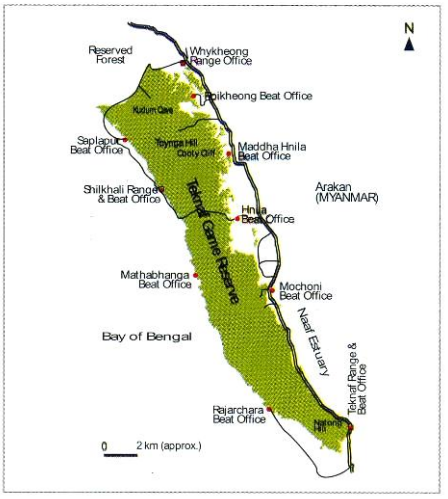
Satchari National Park



Rema-Kalenga Wildlife Sanctuary

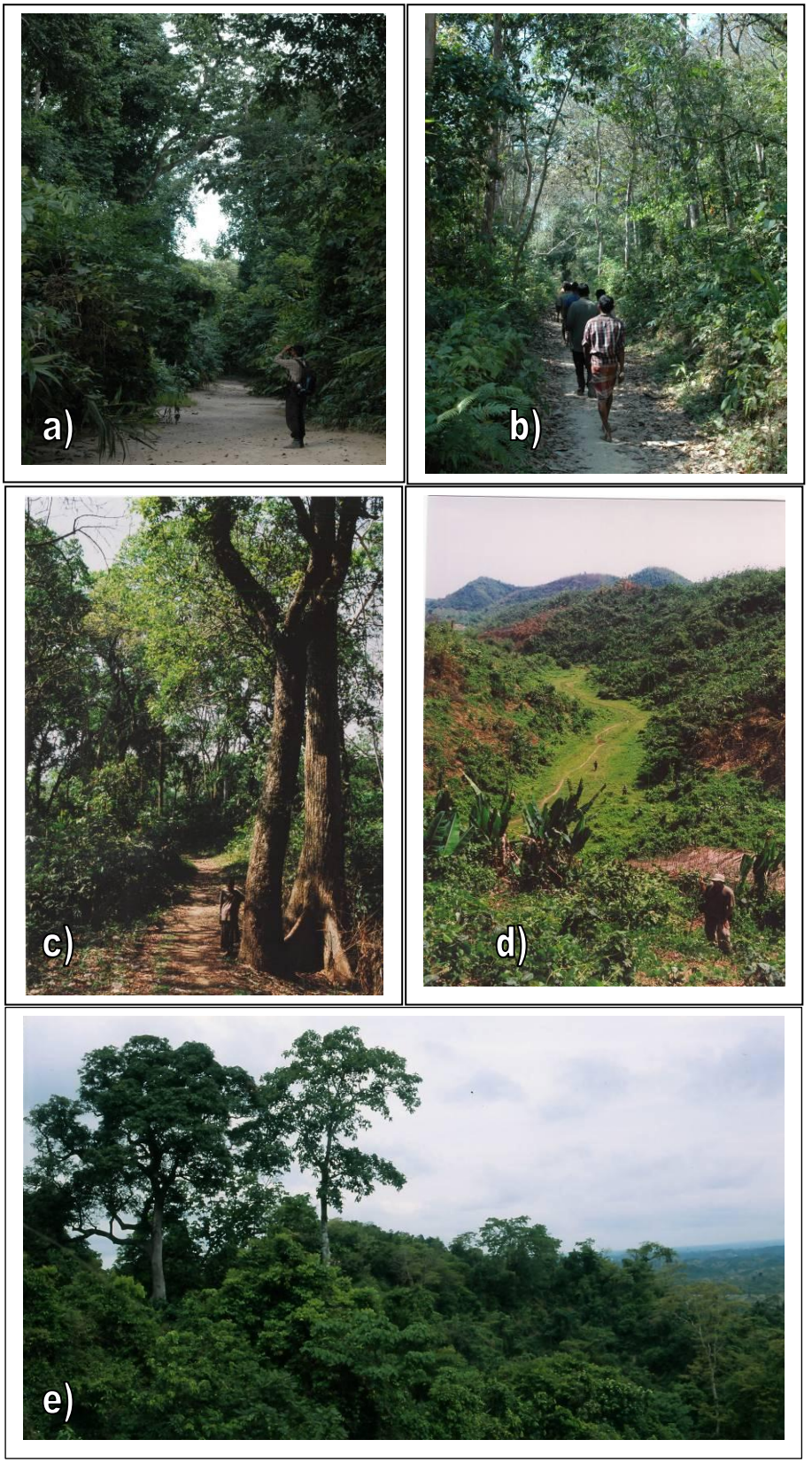


Chunati Wildlife Sanctuary



Teknaf Game Reserve

Figure 3. Five priority Existing Direct sites of IPAC (i.e. NSP sites included in IPAC) where the bird monitoring was conducted.



View of five NSP sites: a) Lawachara NP, b) Satchari NP, c) Rema-Kalenga WS, d) Chunati WS, and e) Teknaf WS.

3. MATERIAL AND METHODS

3.1. Material Used

Since the monitoring had to be conducted by following simple methods (so that the local communities could participate and continue the monitoring in the future), no sophisticated equipment was used for data collection and analyses. A few things that were used in the filed are binoculars (Nikon 10x30) for better observation and identification of birds, books (Ali and Ripley 1987, Grimmett *et al.* 1998, Kazmierczak 2000, Rasmussen and Anderton 2005, Siddiqui *et al.* 2008, Khan 2008a) 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 monitoring team moves straight (roughly), and a standard data sheet (Appendix I) to record the raw data in the field. Two Canon digital camera bodies (EOS 7D and EOS 50D), two Canon lenses (300 mm and 17-135 mm) and one Canon Speedlight 580 EX-II-800 were used to take photographs of birds. The sound recorders (Marantz recorder and Sennheizer microphone) were used to record the sounds of birds. The photographs and recorded sounds of birds not only were used to correctly identify the birds, but were good documents of the presence of different species of birds. Moreover, a pair of Motorola two-way radios (range: 8 km) were used for communication whenever the monitoring team was scattered.

3.2. Selection of Indicator Birds

After having discussion with different experts the indicator species of birds were selected, which met all the following criteria –

- Habitat-specific birds that will not colonize outside the particular habitat.
- Live in different strata or microhabitat and normally feed on different types of food.
- Relatively more sensitive to any change in their habitat.
- Mostly noisy and colorful birds (least likely to miss during the counts).
- Breeding residents.

In case of five New Direct sites (Kaptai, Fasiakhali, Medakachapia, Khadimnagar and Madhupur) a total of ten species of birds were selected as indicators for assessment of the overall condition of wilderness in each of the two different habitat types: i) mixed-evergreen forest, and ii) deciduous forest (Tables 4a, 4b). Seven of the indicator birds were common in all the five monitoring sites, others were not common in mixed-evergreen and deciduous forest sites. Notably, five of the selected indicator birds (Tables 4a, 4b), i.e. Red Junglefowl (*Gallus gallus*), Greater Racket-tailed Drongo (*Dicrurus paradiseus*), White-rumped Shama (*Copsychus malabaricus*), Hill Myna (*Gracula religiosa*) and Puff-throated Babbler (*Pellorneum ruficeps*) were previously used as indicators during NSP (i. e. five priority Existing Direct sites of IPAC, which also monitored in 2012) and were found suitable (Khan 2008b, Khan and Aziz 2012). Three other species, i.e. Oriental Pied Hornbill (*Anthracoceros albirostris*), Red-headed Trogon (*Harpactes erythrocephalus*) and White-crested Laughingthrush (*Garrulax leucolophus*) that were used as indicators during NSP, were found unsuitable as indicators since they are either absent or rare in four mixed-evergreen forest sites where the monitoring was conducted. These, however, were counted in five priority Existing Direct sites (Table 5).

Table 4a. Ten indicator bird species for four (Kaptai, Fasiakhali, Medakachapia and Khadimnagar) New Direct mixed evergreen forest sites

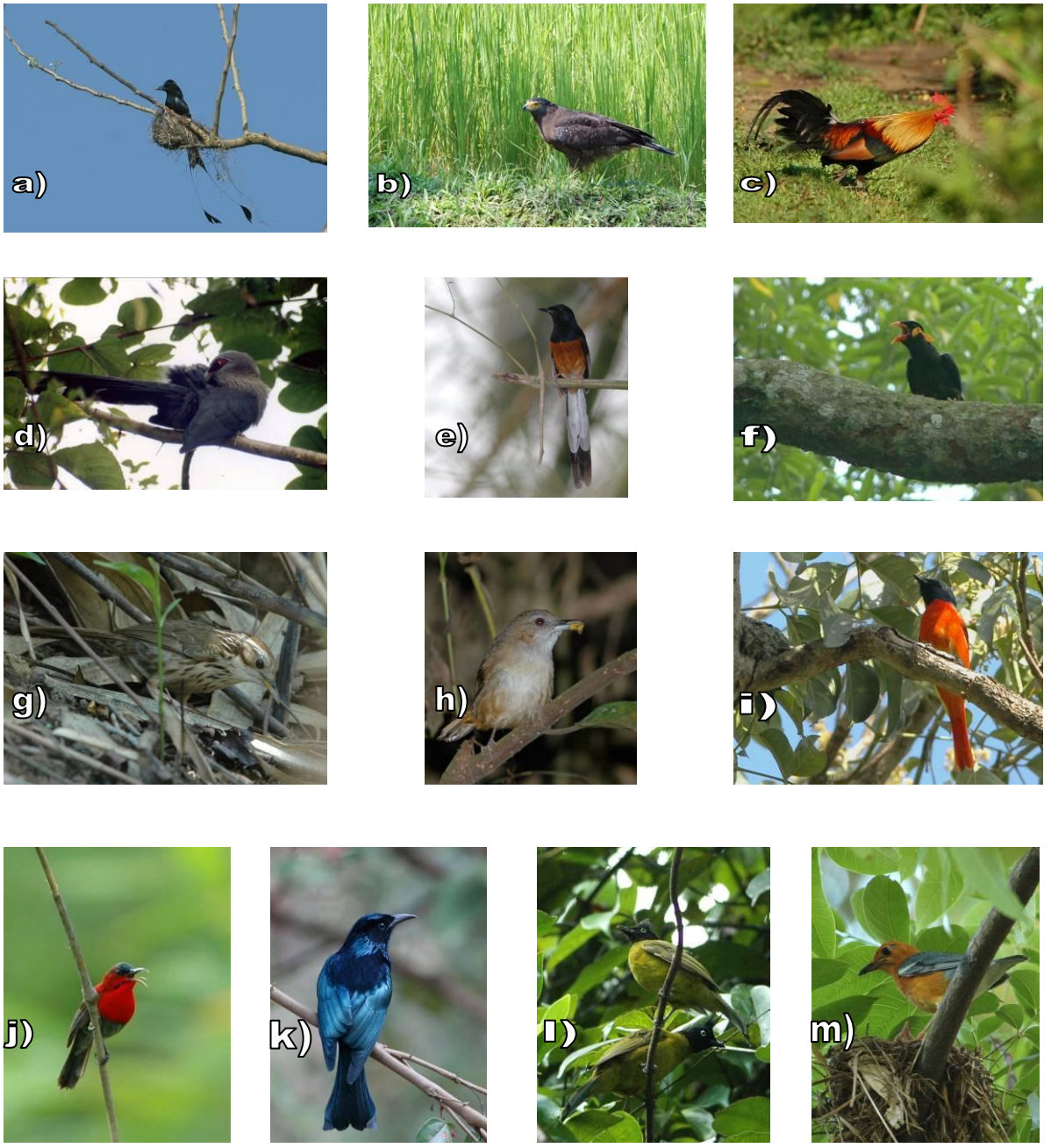
Sl. No.	English Name	Scientific Name	Forest Stratum Where it Primarily Lives	Main Food
1	Greater Racket-tailed Drongo	*Dicrurus paradiseus*	Middle	Insects
2	Crested Serpent Eagle	*Spilornis cheela*	Middle	Small vertebrates
3	Red Junglefowl	*Gallus gallus*	Ground	Grains
4	Green-billed Malkoha	*Phaenicophaeus tristis*	Middle	Insects
5	White-rumped Shama	*Copsychus malabaricus*	Middle	Invertebrates
6	Hill Myna	*Gracula religiosa*	Upper	Fruits
7	Puff-throated Babbler	*Pellorneum ruficeps*	Ground	Invertebrates
8	Abbott's Babbler	*Malacocincla abbotti*	Lower	Invertebrates
9	Scarlet Minivet	*Pericrocotus flammeus*	Upper	Insects
10	Crimson Sunbird	*Aethopyga siparaja*	Middle	Flower nectar

Table 4b. Ten indicator bird species for one (Madhupur) New Direct deciduous forest site

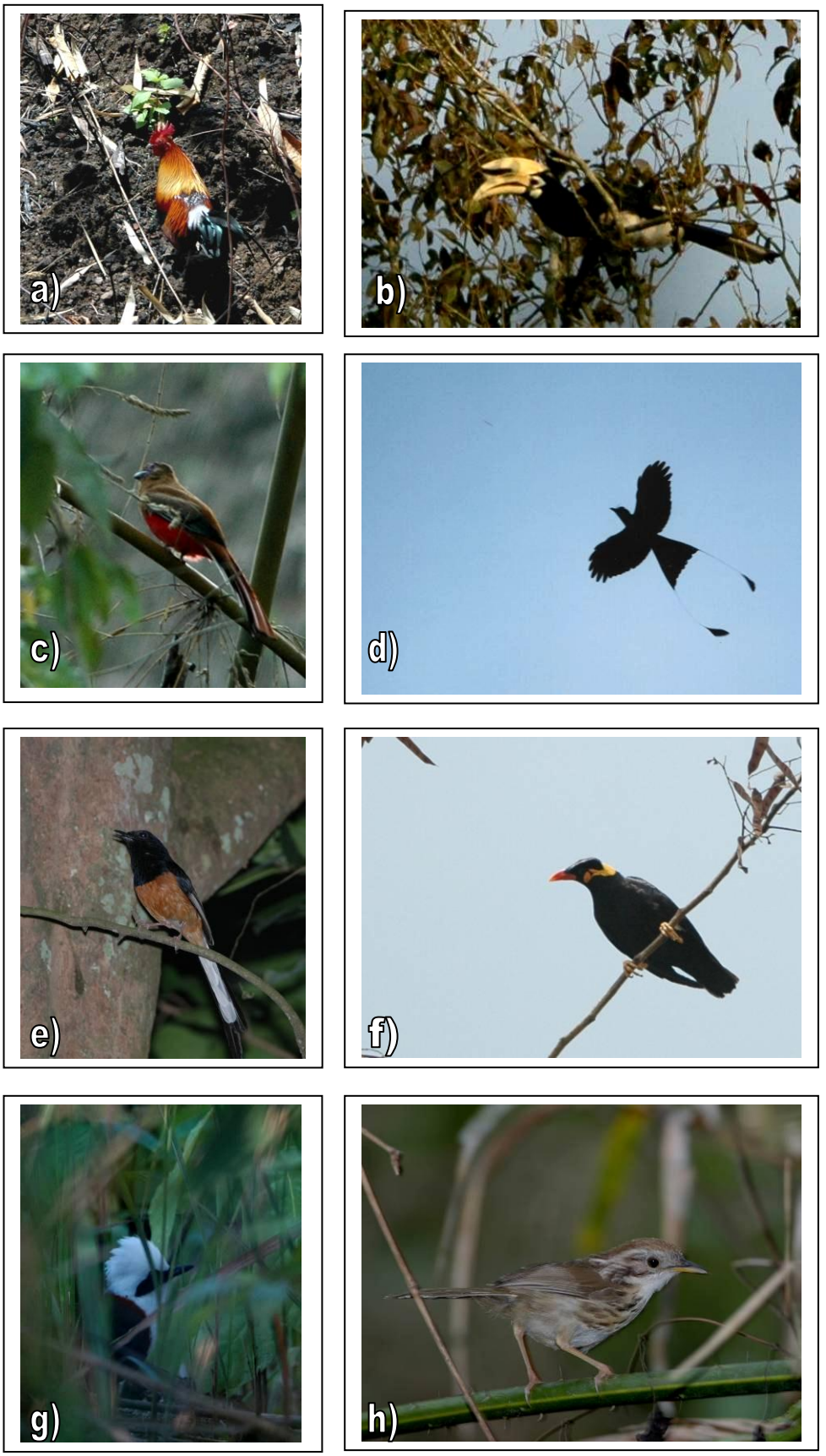
Sl. No.	English Name	Scientific Name	Forest Stratum Where it Primarily Lives	Main Food
1	Crested Serpent Eagle	*Spilornis cheela*	Middle	Small vertebrates
2	Red Junglefowl	*Gallus gallus*	Ground	Grains
3	Green-billed Malkoha	*Phaenicophaeus tristis*	Middle	Insects
4	Spangled Drongo	*Dicrurus hottentottus*	Middle	Insects
5	White-rumped Shama	*Copsychus malabaricus*	Middle	Invertebrates
6	Black-crested Bulbul	*Pycnonotus melanicterus*	Middle	Fruits
7	Puff-throated Babbler	*Pellorneum ruficeps*	Ground	Invertebrates
8	**Orange-headed**	*Zoothera citrina*	Lower	Invertebrates
9	Scarlet Minivet	*Pericrocotus flammeus*	Upper	Insects
10	Crimson Sunbird	*Aethopyga siparaja*	Middle	Flower nectar

Table 5. Eight indicator bird species for five (Lawachara, Satchari, Rema-Kalenga, Chunati and Teknaf) Existing Direct sites (i.e. five NSP sites)

Sl. No.	English Name	Scientific Name	Forest Stratum Where it Primarily Lives	Main Food
1	Red Junglefowl	*Gallus gallus*	Lower	Grains
2	Oriental Pied Hornbill	*Anthracoceros albirostris*	Upper	Fruits
3	Red-headed Trogon	*Harpactes erythrocephalus*	Middle	Insects
4	Greater Racket-tailed Drongo	*Dicrurus paradiseus*	Middle	Insects
5	White-rumped Shama	*Copsychus malabaricus*	Middle	Invertebrates
6	Hill Myna	*Gracula religiosa*	Upper	Fruits
7	White-crested Laughingthrush	*Garrulax leucolophus*	Lower	Invertebrates
8	Puff-throated Babbler	*Pellorneum ruficeps*	Lower	Invertebrates



Indicator bird species for IPAC sites: a) Greater Racket-tailed Drongo, b) Crested Serpent Eagle, c) Red Junglefowl, d) Green-billed Malkoha, e) White-rumped Shama, f) Hill Myna, g) Puff-throated Babbler, h) Abbott's Babbler, i) Scarlet Minivet, j) Crimson Sunbird, k) Spangled Drongo, l) Black-crested Bulbul, and m) Orange-headed Thrush



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

It was assumed that the improvement or degradation of the forest condition will have a direct impact on the feeding and breeding successes of the indicator birds, which in turn will be reflected in the changes of the population densities of these species (Morrison 1986, Temple and Wiens 1989, Canterbury *et al.* 2000, Browder *et al.* 2002).

3.3. Monitoring Team

The monitoring team included research students, birdwatchers and the local communities living around or close to the project sites, including the local Ecotour Guides and Co-management Committee/Council members of IPAC, together with the local officials of the Forest Department and IPAC. A wildlife expert (Dr M. Monirul H. Khan) from Jahangirnagar University, Savar, Dhaka, had led the whole team. The team members were formally and informally trained before and during the monitoring so that they could play significant role in the survey and can replicate the process. The participants from local community also gathered information on birds on an ad hoc basis whenever they had visited the forests for different activities other than the formal bird monitoring.

3.4. Monitoring Methods

The methods for bird monitoring were selected on the basis of simplicity and effectiveness so that even the uneducated local people could participate and do the work on their own. It was decided that in the forest sites the survey will be conducted in the rainy season (March-October) when the resident birds mainly breed and call. Notably, similar monitoring of indicator birds was conducted during NSP and was found effective in representing the trend of management impacts (Khan 2008b, Khan and Aziz 2012). One main concern was to involve local communities and other stakeholders in the monitoring so that they own the survey outcomes and can continue the work after the completion of the project. Therefore, it was not very easy to select the monitoring methods that would be simple and feasible, yet scientifically valid and reliable to indicate the changes in the population densities of indicator bird species, and register the status of birds, which in turn will indicate the status of co-management impacts of IPAC. Taking all these into account, strip transects sampling and opportunistic survey methods were selected (Table 6).

For five priority New Direct sites of IPAC the baseline monitoring was conducted in 2009, with about 30 observation-days in the field. This was repeated annually in 2010 and 2012 in order to understand the co-management impacts in these sites during IPAC. For five priority Existing Direct sites of IPAC (i.e. five NSP sites) the baseline survey was conducted in 2005, with about 30 observation-days in the field. This was repeated annually in 2006, 2007 and 2008 to understand the impacts of co-management during NSP. Finally, this was repeated in 2012 to understand the impacts of co-management to these sides during IPAC.

Indicator bird monitoring in IPAC sites (both New Direct and Existing Direct Sites): a) Fasiakhali WS, b) Medakachapia NP, c) Khadimnagar NP, d) Satchari NP, e) Rema-Kalenga WS, f) Chunati WS, and g) Teknaf WS

Table 6. Different methods considered for bird monitoring

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 distance 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**
Distance 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 distance sampling 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 system	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 densities of indicator bird species. This method is simple, so even the local people could participate. In this method some permanent strips were selected where the total counts of the objects (indicator birds) were made (Figure 4). The observers slowly moved (ca. 1.5 km/hr) along a relatively straight line (basal line) through the study area and counted the objects from both sides. The observation-range (half-width of the strip) varies depending on the visibility of the study area. For the New Direct forest sites (Kaptai, Fasiakhali, Medakachapia, Khadimnagar and Madhupur) the observation-range of 25 m on either side was found suitable, so the width of transects was 50 m. In case of Existing Direct sites (Lawachara, Satchari, Rema-Kalenga, Chunati and Teknaf, which are relatively more dense compared to New Direct sites) the width of transects was 40 m. The initial location of the object was considered while counting, because the object often moveed away after watching the observer(s). If any object was sighted beyond the pre-decided observation-range, or if the object was seen coming from the back (in order to avoid duplication), the object was not counted. A standard data sheet was used to record the counts of indicator birds (Appendix I).

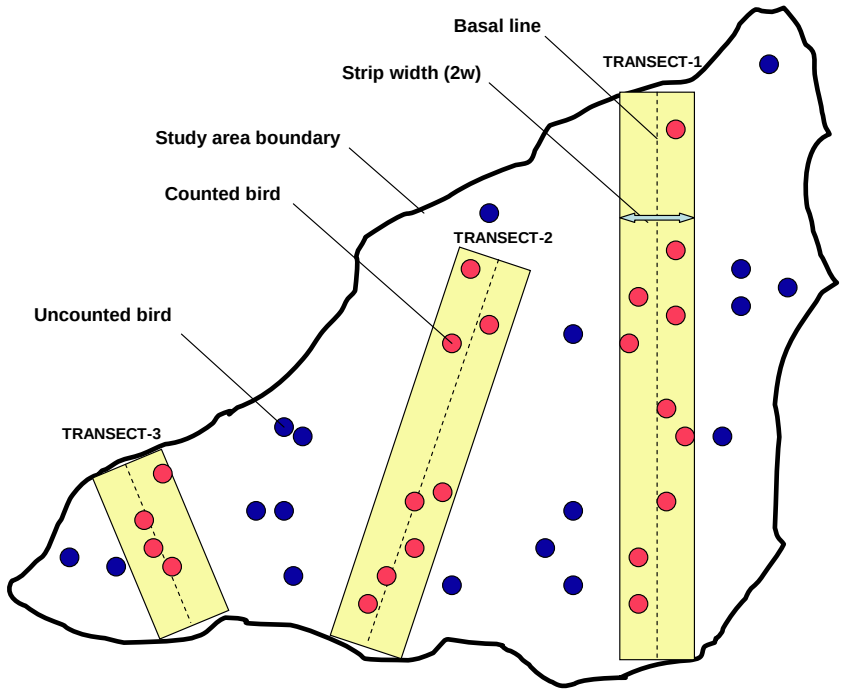


Figure 4. Diagrammatic representation of strip transect sampling to estimate bird population density in a study area.

The monitoring was conducted in early mornings and late afternoons when the birds were most active. Transects were located in areas that are suitable in terms of accessibility and observation. The relatively natural and intact areas of forests were given priority, not only because of the richness of biodiversity but IPAC is focusing more on the management of these areas.

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 centre-line), 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 as –

$$D = N / 2wL$$

Since the project sites are not very big, it was not possible to make very long or many transects. Hence, each transect was repeated, but each of them were treated as a new transect, i.e. a new k. The lengths of transects varied from 0.5-1.5 km.

This method assumes that all objects in the strip are recorded, so the observer(s) were very careful in observing and recording all the objects inside the strips. 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 that were actually present, the error is statistically negligible. The more areas covered, or more the transects repeated, the less error in mean density estimates. Even if any basal line of a transect is slightly undulated, the observation-strip were 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. In case of any confusion regarding identification, photographs were taken and sounds were recorded, if possible, and the identification was confirmed later on, comparing with reference pictures and sounds. The main weakness of this method is that the level of error cannot be estimated.

3.4.2 OPPORTUNISTIC (AD LIBITUM) SAMPLING

In opportunistic or *ad libitum* sampling any important or interesting observation/information is recorded at any time while in the field. This sampling method is suitable for recording the occurrence, relative abundance and distribution of different species of birds and other wildlife (Appendix I). The birds were identified by using some authentic books (e.g., Grimmett *et al.* 1998, Rasmussen and Anderton 2005). The relative abundance of birds (Very Common – 76-100% chance of being identified in its habitat, Common – 51-75% chance of being identified in its habitat, Uncommon – 26-50% chance of being identified in its habitat, and Rare – 25% or less chance of being identified in its habitat) were assessed on the basis of their chances of relative frequencies of sightings in the field, which were verified by interviewing local people.

The 'Resident' species is defined as the species that lives in Bangladesh year-round and breeds in Bangladesh, the 'Winter Visitor' spends the winter in Bangladesh and does not breed in Bangladesh, the 'Summer Visitor' spends the summer in Bangladesh and breeds in Bangladesh, and 'Vagrant' erratically visits Bangladesh and does not normally breed in Bangladesh.

Although the opportunistic sampling is an informal way of collecting information, the outcome can be very rewarding. However, if this is not carried out with sufficient care, wrong information can be incorporated that might lead to biased results. This method is particularly useful in recording bits and pieces of important observations and information on rare and endangered species that could not be studied by any other method due to their rarity. Using opportunistic sampling the following aspects were recorded for different species of birds –

- Principal diet.
- Principal foraging guild.
- Status or relative abundance.
- Site-wise (IPAC sites) distribution.
- Breeding season (based on mating, nesting, feeding young, etc.).
- Threats (lack of food, lack of nesting place, lack of habitat, hunting and trapping, predation, etc.).

4. RESULTS AND DISCUSSION

Since this year's (2012) indicator bird monitoring was the last monitoring under IPAC, both five New Direct (Kaptai, Fasiakhali, Medakachapia, Khadimnagar and Madhupur) and five Existing Direct (Lawachara, Satchari, Rema-Kalenga, Chunati and Teknaf) sites were covered. Notably, the priority Existing Direct sites were previously covered from 2005 to 2008 under NSP. This year's results represent the monitoring that was conducted during a six-month period (March-August), with about 50 observation-days in the field.

The densities of ten indicator species of birds in each of the five New Direct sites of IPAC were estimated and compared with the density estimates that were conducted in 2009 and 2010. In case of five Existing Direct sites the densities of eight indicator species of birds were estimated and compared with the annual estimates that were conducted during 2005-2008.

A list of all the bird species (including the indications of their principal diet, principal foraging guild, status, and site-wise distribution) recorded in five New Direct sites (Appendix II) and five Existing Direct sites (Appendix III) were produced. Moreover, the main threats to birds and other wildlife, observed in the field, have pointed out.

The same monitoring needs to be repeated in the years to come so that the temporal changes in the densities of indicator birds are known, which will be the indicators of management impacts in the future, even after the completion of IPAC. Moreover, similar monitoring, or at least some sort of rapid assessment of the indicator bird densities in other IPAC sites should be conducted, which could not be covered during our bird monitoring due to lack of resources.

Other than the findings on birds, the research students, birdwatchers and the local people who were involved in the monitoring have learned the monitoring techniques and identification of birds. Now they have the capacity to conduct similar surveys and research on their own.

Since the survey team had ventured the most remote and risky areas, where people normally do not go, and regularly watched the ten IPAC sites, they represented IPAC in the remote and risky areas, and the illegal loggers and poachers knew that there are people to watch what is going on in the area and report it. To some extent this had discouraged people to illegally log any tree or poach any animal.

4.1. Population Densities of Indicator Bird Species

The population density, i.e. the average number of individuals per square kilometer, was estimated for each of the indicator bird species in five New Direct and five Existing Direct sites of IPAC and compared with the annual density estimates of previous years (Figures 5a-e and 6a-e). Red Junglefowl (*Gallus gallus*; a ground-dwelling indicator bird) showed the tendency of increasing density in all the ten sites. In five New Direct sites the increase was 9.5-34.6% and in five Existing Direct sites the increase was 60.3-180.6% from the first year (2009 and 2005, respectively) of monitoring. Puff-throated Babbler (*Pellorneum ruficeps*; an undergrowth- and bush-dwelling indicator bird) also showed the tendency of increasing density in most of the ten sites, especially in five Existing Direct sites. In five New Direct sites the increase was 3.1-8.5% and in five Existing Direct sites the increase was 33.9-103.1% from the first year of monitoring. Abbott's Babbler (*Malacocincla abbotti*; an undergrowth- and bush-dwelling indicator bird), which was monitored only in four of five New Direct sites, has also showed the tendency of increasing density (1.7-4.9%), albeit at a lesser rate.

Hill Myna (*Gracula religiosa*; a top-canopy-dwelling indicator bird) showed the tendency of decreasing density in all the ten sites. In five New Direct sites the decrease was 0-10.5% and in five Existing

Direct sites the decrease was 3.3-11.8% from the first year of monitoring. Oriental Pied Hornbill (*Anthracoceros albirostris*; a top-canopy-dwelling indicator bird), which was monitored only in five Existing Direct sites, has also showed the tendency of decreasing density (35.3-60.2%). The densities of other indicator species of birds remained more or less stable in all sites (Figures 5a-e, 6a-e).

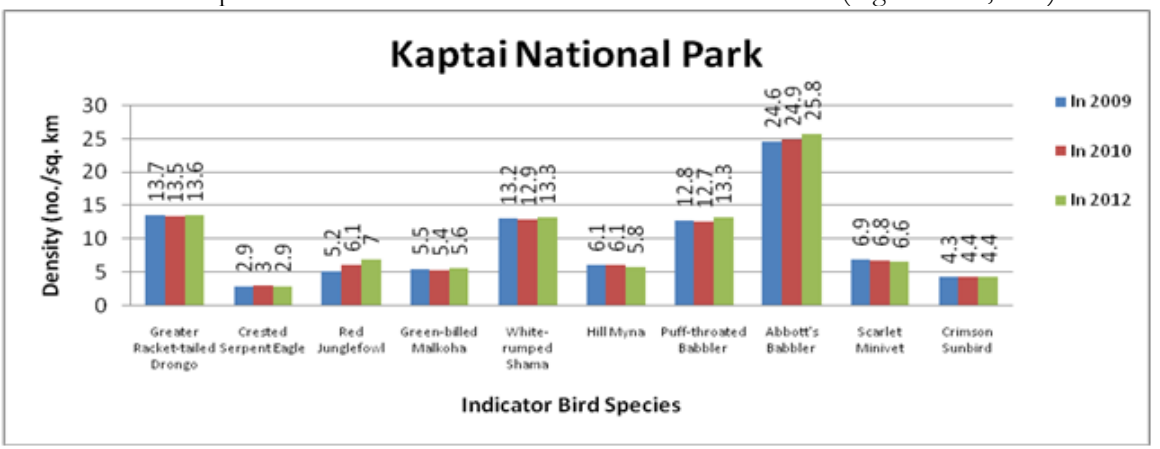


Figure 5a. Population densities (no./sq. km) of ten indicator bird species in Kaptai National Park in 2009, 2010 and 2012.

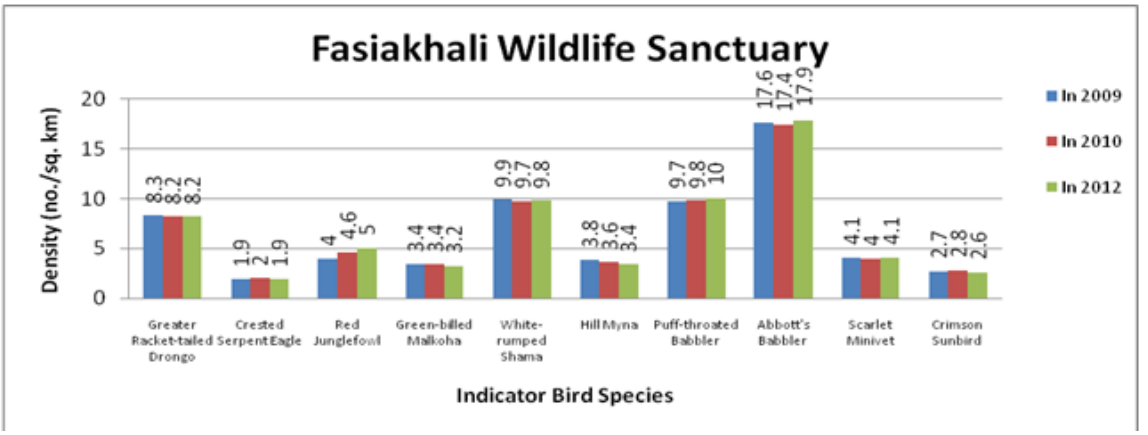


Figure 5b. Population densities (no./sq. km) of ten indicator bird species in Fasiakhali Wildlife Sanctuary in 2009, 2010 and 2012.

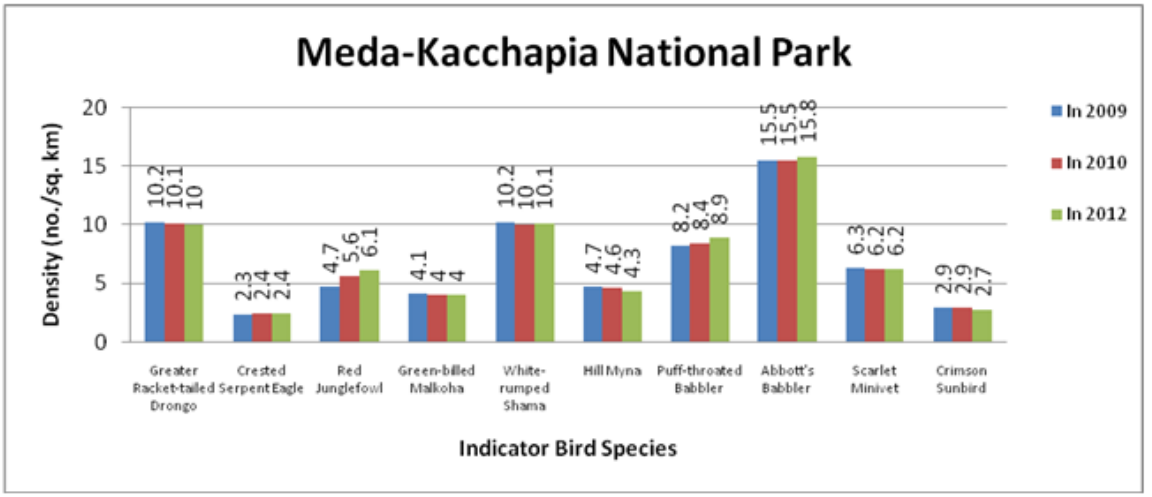


Figure 5c. Population densities (no./sq. km) of ten indicator bird species in Medakachapia National Park in 2009, 2010 and 2012.

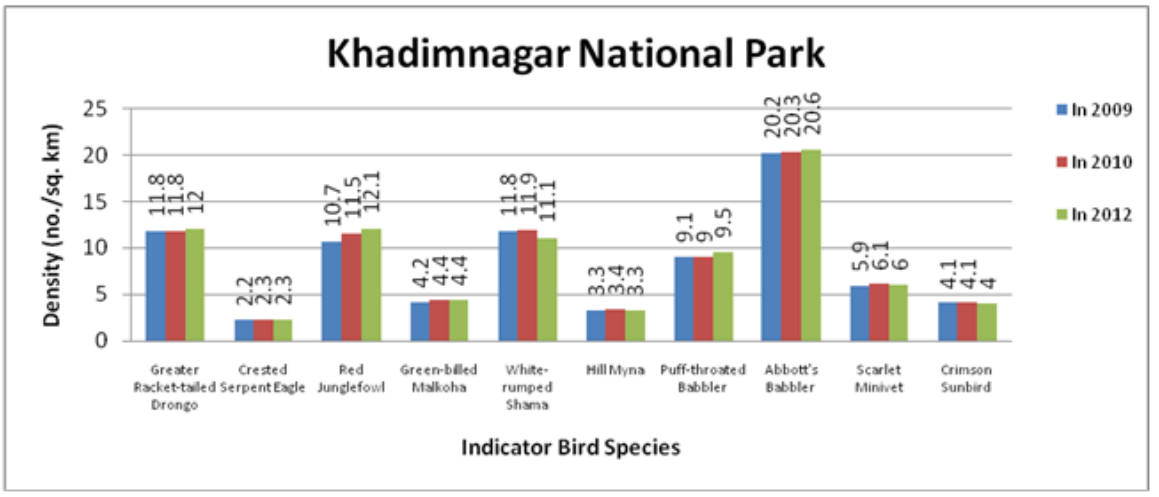


Figure 5d. Population densities (no./sq. km) of ten indicator bird species in Khadimnagar National Park in 2009, 2010 and 2012.

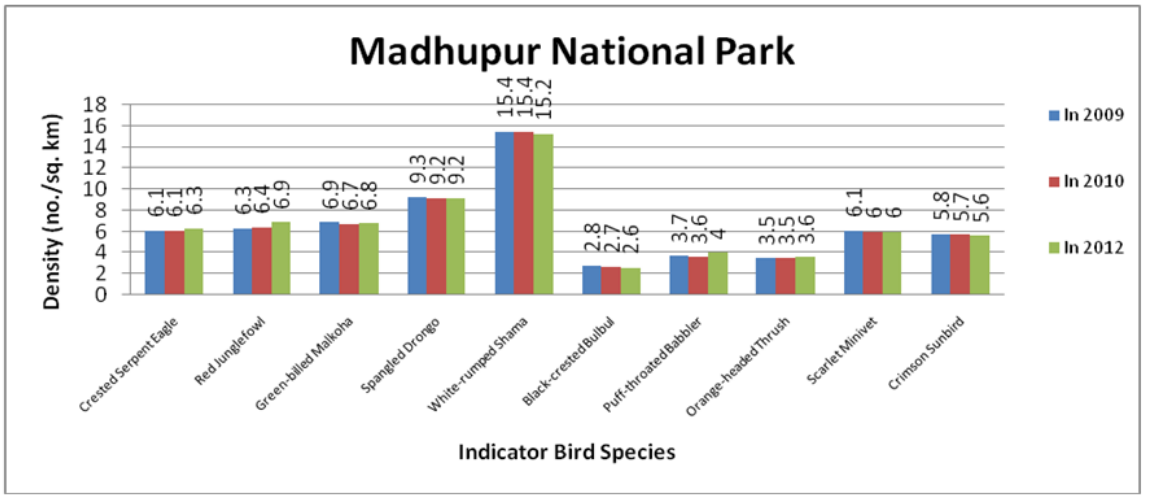


Figure 5e. Population densities (no./sq. km) of ten indicator bird species in Madhupur National Park in 2009, 2010 and 2012.

In four New Direct mixed evergreen forest sites Abbott's Babbler had the highest density (15.8-25.8/km^2) among the indicator species of birds, whereas in only deciduous forest site where the monitoring was conducted (Madhupur), White-rumped Shama (*Copsychus malabaricus*) had the highest density (15.2/km^2). In five Existing Direct mixed evergreen forest sites Puff-throated Babbler had the highest density (19.9-44.2/km^2).

Increase of the densities of three species of indicator birds (Red Junglefowl, Puff-throated Babbler and Abbott's Babbler) of the lower storey indicates an improvement of undergrowths and bushes, and regeneration of forests, which caused the increment of the carrying capacity and nesting sites for these three species. The community patrolling, alternative income generation, awareness and other programs by IPAC played the key role in reducing the clearing of understory vegetation for firewood as well as reducing the hunting pressure.

The increase of the densities of three species of indicator birds 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, it appears that some illegal logging of selective timber trees and encroachment of forest land mainly for agricultural (particularly in Teknaf and Rema-Kalenga) still

persist, which probably caused the decline of Hill Myna and Oriental Pied Hornbill. These two species of indicator birds live in the top canopy, where they feed and nest (in holes of large trees), and hence is severely affected if the large trees are selectively removed from the forest. The population densities of other species of indicator birds that occur in the middle storey of the forest have remained more or less unchanged, indicating that the middle storey have not been changed significantly over the last few years.

Only the populations of breeding resident indicator birds were monitored in each site, because the populations of winter visitors, summer visitors and vagrants depend also on the resource status of other areas that they depend on (Temple and Wiens 1989).

Species associations with habitat type depend partly on the detectability of the species during the count period, because the species are differentially detected depending on the frequency and loudness of their voices, and their relative visibility due both to behavioral and physical traits and the habitat in which they occur (Browder *et al.* 2002). Therefore, the indicator birds selected at the beginning of this study were mainly vocal and conspicuous so that there was very little chance of missing them during strip-transect sampling.

Although birds are widely used as ecological indicators, it is also criticized by some experts (Martin and Li 1992; Martin 1993, 1995). According to them the individual species are questionable indicators of forest community responses, because co-occurring species typically differ in habitat requirements and life histories and can respond independently to environmental variations (James *et al.* 1984). Others think that individual species may function as indicators of a restricted component of the community, such as the abundance of other members of the same guild (Severinghaus 1981). Moreover, large increase in one or two species can mask the decline or loss of others in the same guild (Mannan and Meslow 1984).

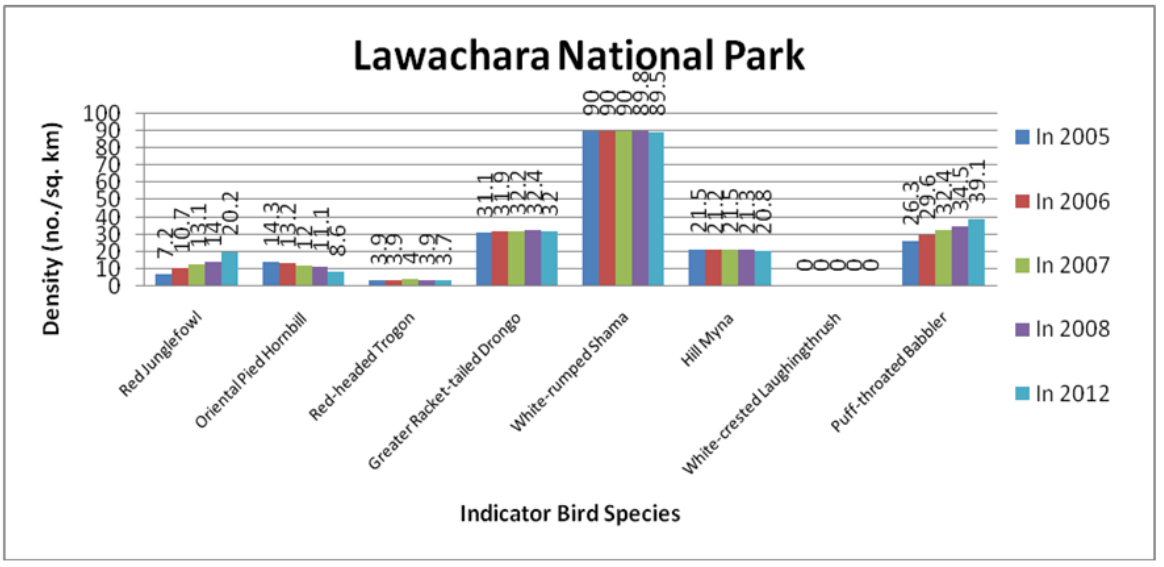


Figure 6a. Population densities (no./sq. km) of eight indicator bird species in Lawachara National Park in 2005, 2006, 2007, 2008 and 2012.

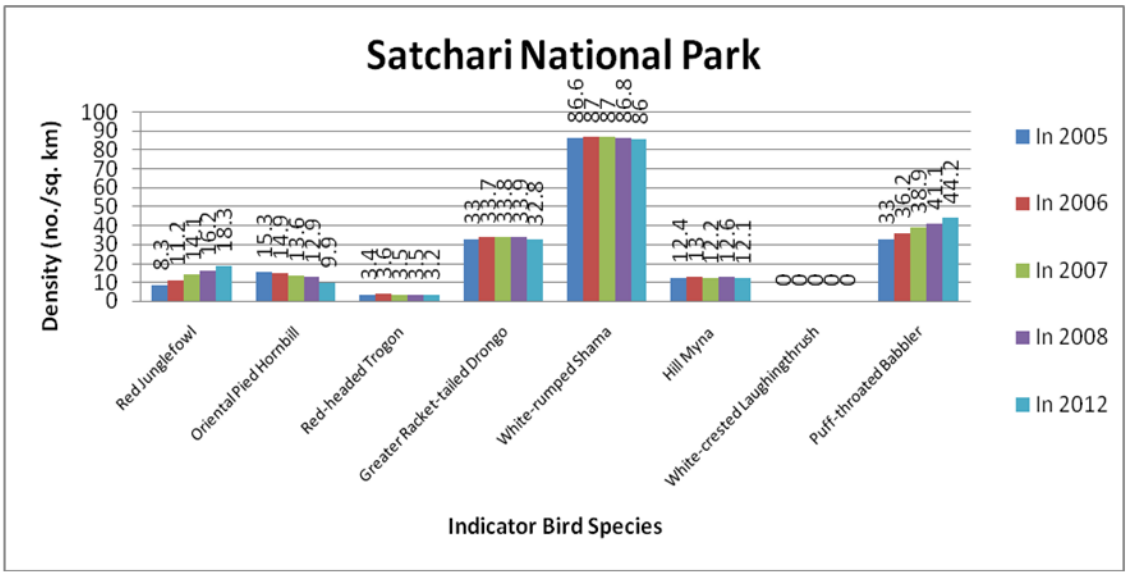


Figure 6b. Population densities (no./sq. km) of eight indicator bird species in Satchari National Park in 2005, 2006, 2007, 2008 and 2012.

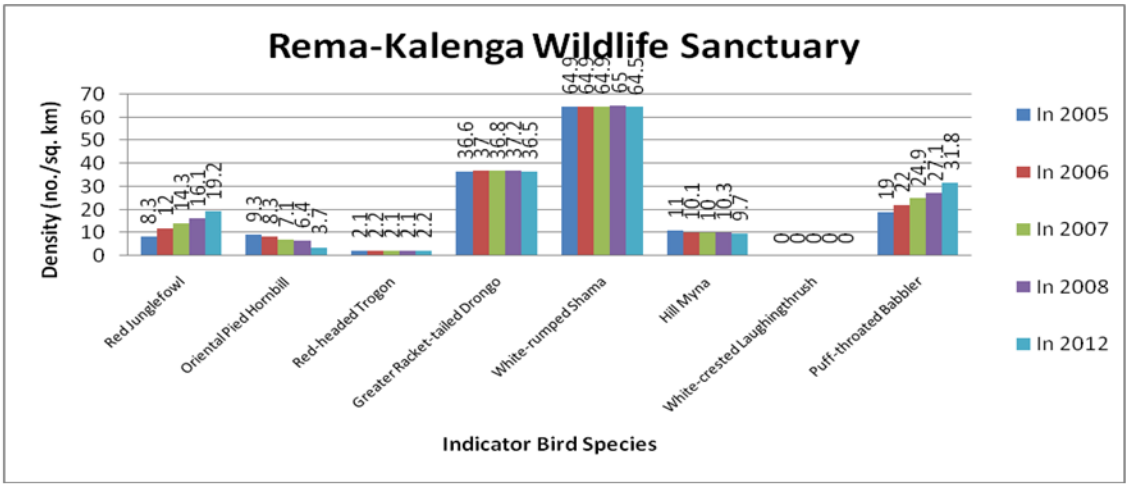


Figure 6c. Population densities (no./sq. km) of eight indicator bird species in Rema-Kalenga Wildlife Sanctuary in 2005, 2006, 2007, 2008 and 2012.

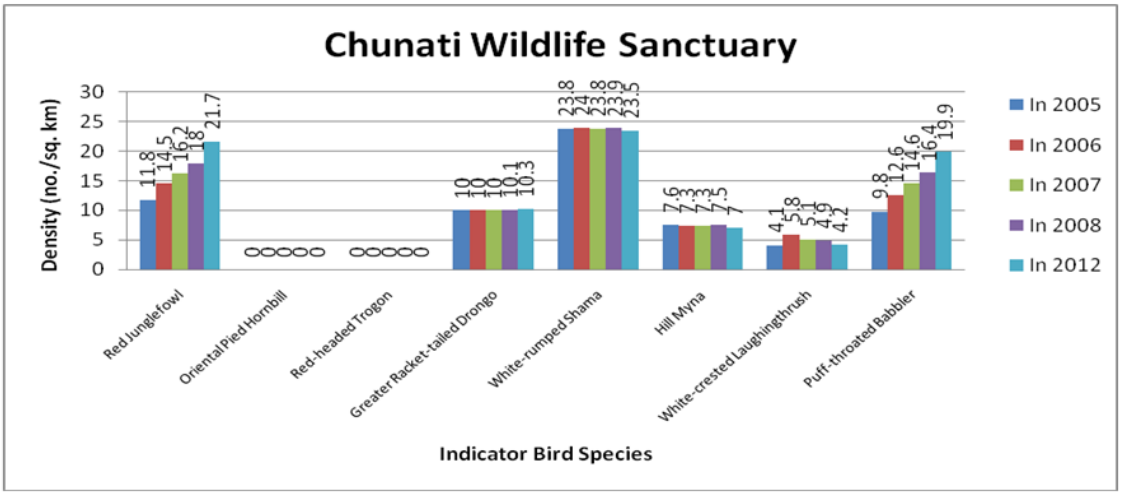


Figure 6d. Population densities (no./sq. km) of eight indicator bird species in Chunati Wildlife Sanctuary in 2005, 2006, 2007, 2008 and 2012.

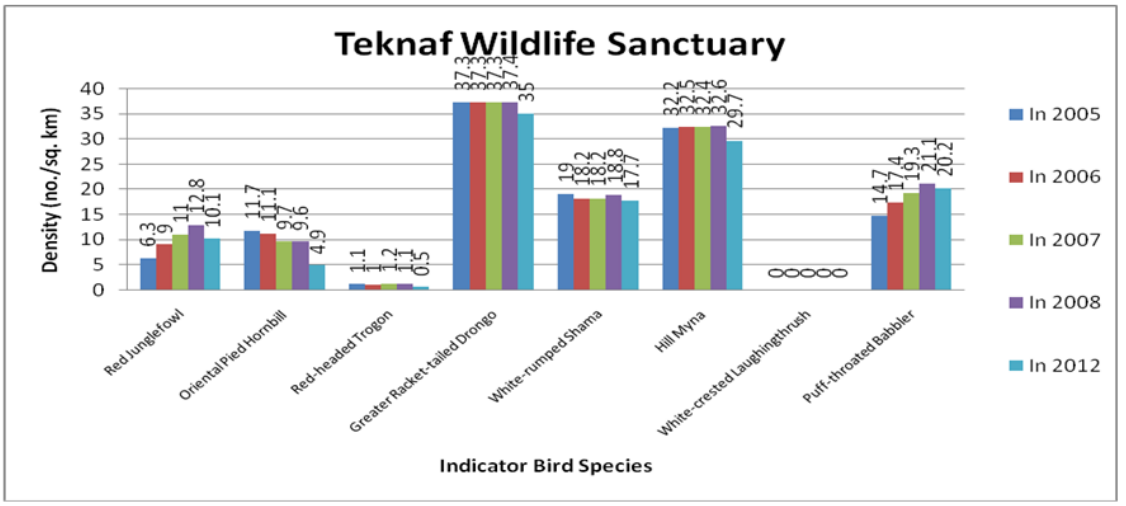


Figure 6e. Population densities (no./sq. km) of eight indicator bird species in Teknaf Wildlife Sanctuary in 2005, 2006, 2007, 2008 and 2012.

4.2. Bird Species Diversity

A total of 249 species of birds was recorded during three year's monitoring (2009, 2010 and 2012; only in rainy season) in five New Direct sites of IPAC (Kaptai, Fasiakhali, Medakachapia, Khadimnagar and Madhupur), of which 198 were residents, 39 winter visitors, 6 summer visitors and 6 vagrants (Appendix II). Most (55%) of the birds were insectivorous (Figure 7). Higher proportions of bird species were found to occur in the middle canopy (41%) (Figure 8). Most species of birds were relatively rare (37%) (Figure 9) and the proportion of rare species has increased gradually over the last few years. Among 249 species of birds, the total number of species and the total number of primarily forest species were different in five different New Direct sites (Figure 10). Very strong correlation (r = 0.987626) was found between the total number of bird species and the total number of primarily forest bird species across five monitoring sites.

In five Existing Direct sites (Lawachara, Satchari, Rema-Kalenga, Chunati and Teknaf), on the other hand, a total of 239 species of birds was recorded during five year's monitoring (2005, 2006, 2007, 2008 and 2012; only in rainy season), of which 189 were residents, 39 winter visitors, 6 summer visitors and 5 vagrants (Appendix III). Most (55%) of the birds were insectivorous (Figure 11). Higher proportions of bird species occurs in the middle canopy (42%) and on the ground (33%) (Figure 12). Most species of birds were relatively rare (35%) (Figure 13) and the proportion of rare species has increased gradually over the last few years. Among 239 species of birds, the total number of species and the total number of primarily forest species were different in five different Existing Direct sites (Figure 13). Very weak correlation (r = 0.32014) was found between the total number of bird species and the total number of primarily forest bird species across five monitoring sites.

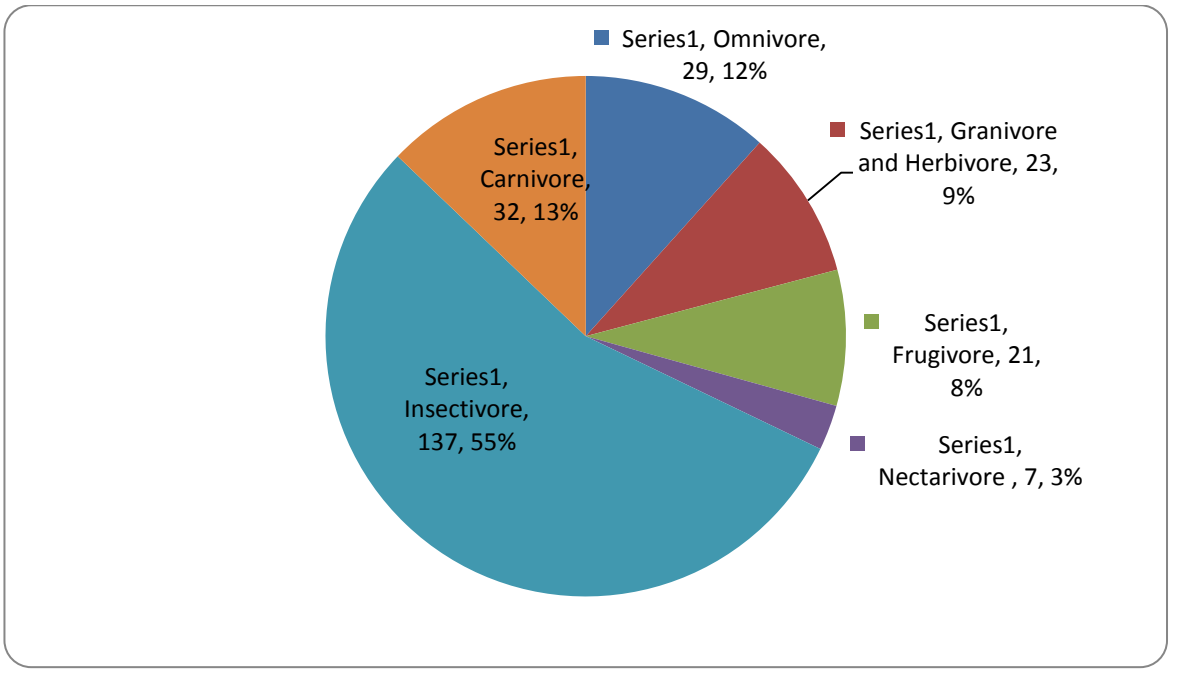


Figure 7. Proportions of bird species of different food habits in five New Direct sites of IPAC.

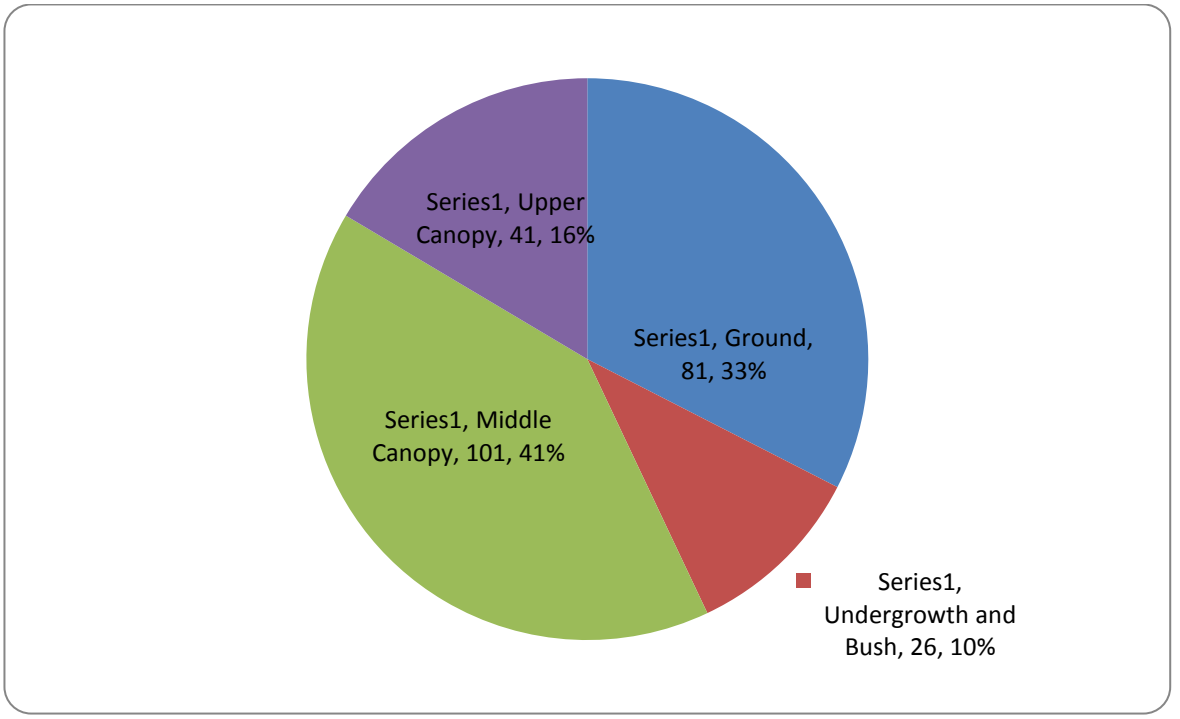


Figure 8. Proportions of different bird species in different strata of the forest in five New Direct sites of IPAC.

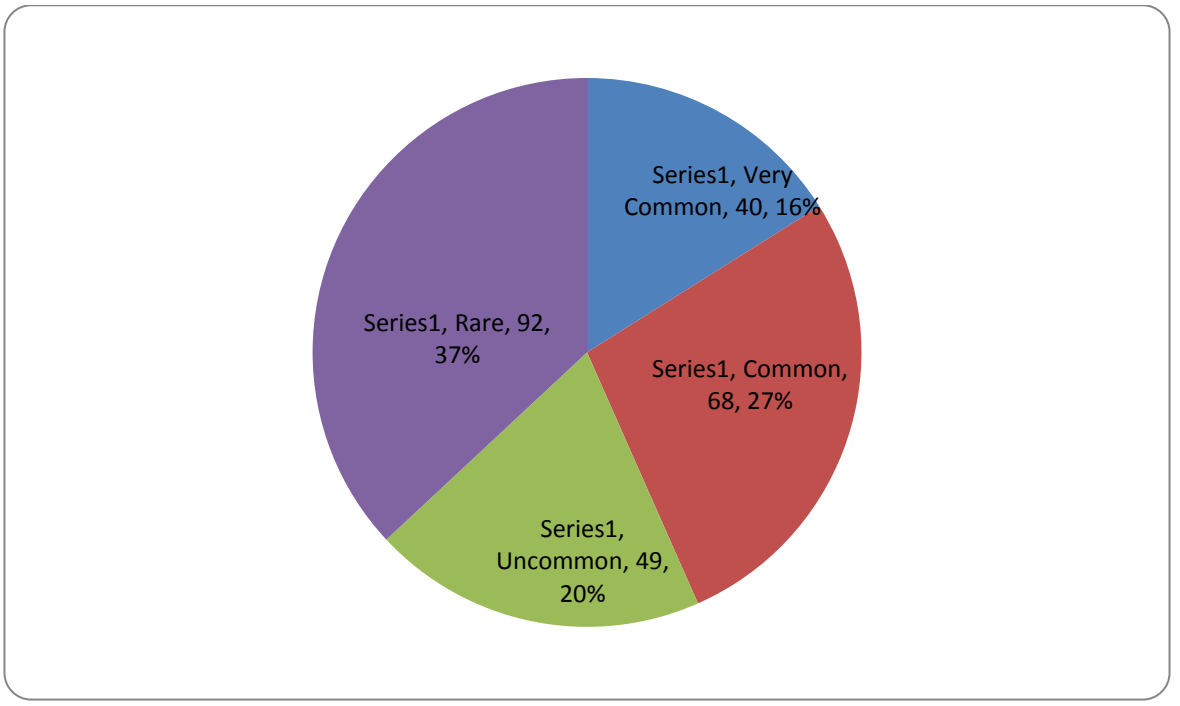


Figure 9. Proportions of Very Common, Common, Uncommon and Rare species of birds in five New Direct sites of IPAC.

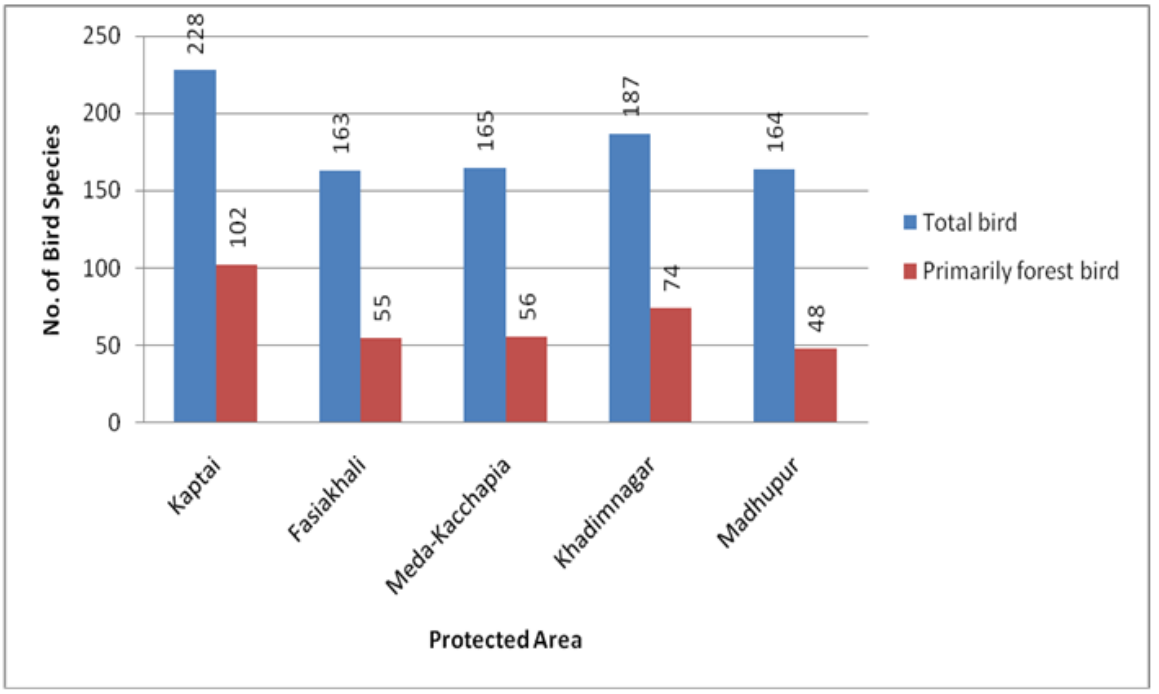


Figure 10. A comparison of the total number of bird species and total number of primarily forest bird species across five New Direct sites of IPAC.

The total bird species recorded in five New Direct sites (249), or in five Existing Direct sites (239) in a limited period of time (in rainy season) in a few years represents over 30% of the birds recorded in Bangladesh (Harvey 1990, IUCN-Bangladesh 2000, Khan 2008a), and almost 3% recorded in the Indian Subcontinent (Grewal *et al.* 2002). A relatively high ratio of rare birds (37% and 35%, respectively) 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) have strengthened the knowledge of bird species diversity and highlighted that a significant proportion of birds are now rare in different parts of the country.

The checklists of birds (Appendices II and III) that were produced, together with their respective principal diet, principal foraging guild, status and site-wise (IPAC sites) distribution for each of the five New Direct and five Existing Direct sites of IPAC will not only enrich the science of ornithology in Bangladesh, but will also help the ecotourists and birdwatchers who will visit these sites. Notably, such checklists of birds for these sites were not available before this monitoring.

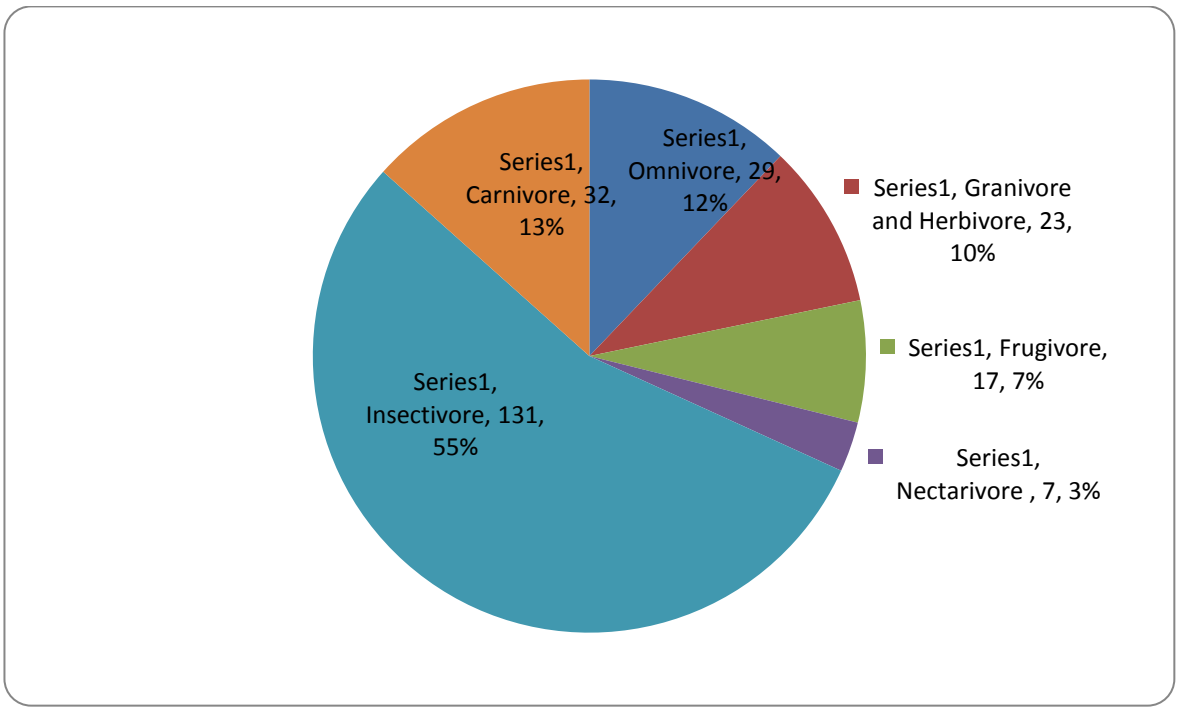


Figure 11. Proportions of bird species of different food habits in five Existing Direct sites of IPAC.

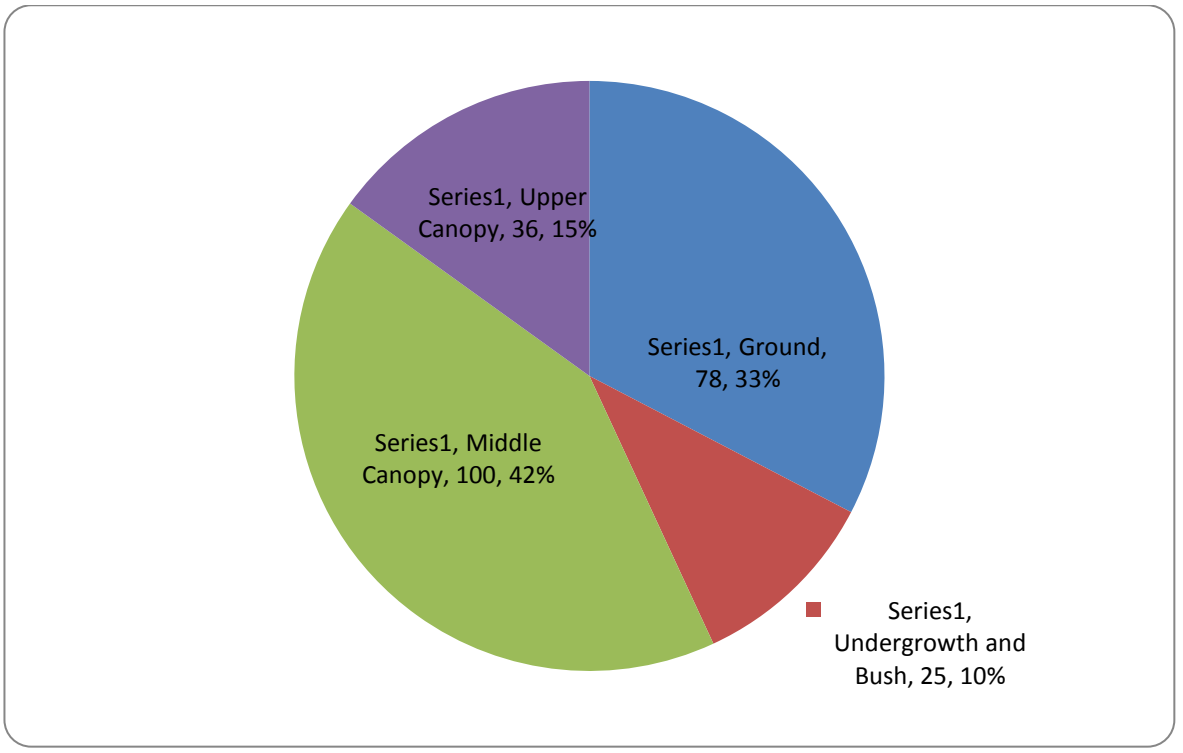


Figure 12. Proportions of different bird species in different strata of the forest in five Existing Direct sites of IPAC.

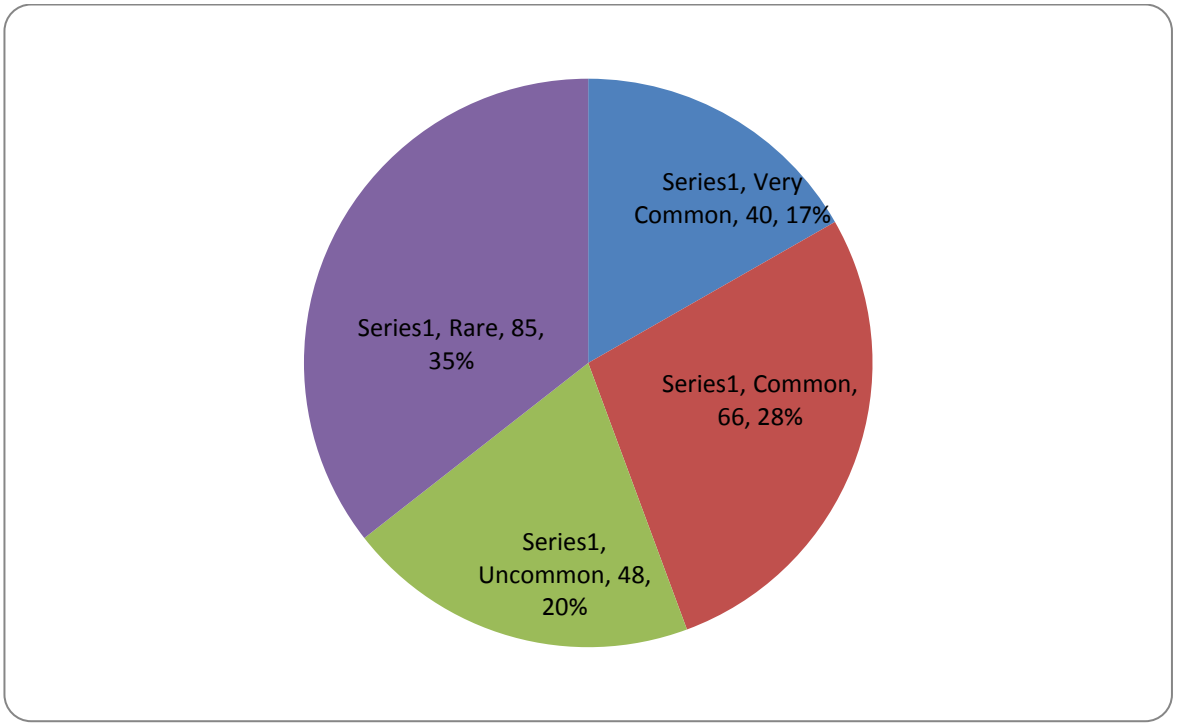


Figure 13. Proportions of Very Common, Common, Uncommon and Rare species of birds in five Existing Direct sites of IPAC.

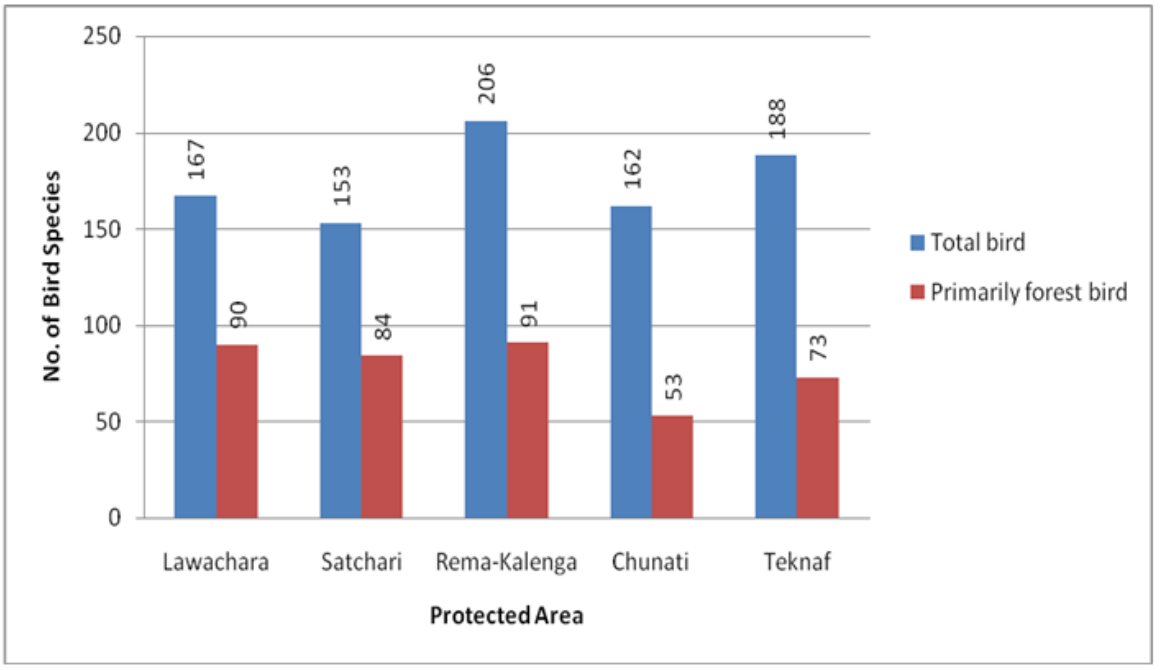


Figure 14. A comparison of the total number of bird species and total number of primarily forest bird species across five Existing Direct sites of IPAC.

4.3. Threats to Birds and Their Habitats

Habitat loss was recorded as the main threat to birds in all the ten IPAC sites where bird monitoring was conducted. Illegal felling of trees and bamboo, illegal harvest of bush and dead trees for fire and conversion of natural forests to agricultural fields and even wetlands for fish culture were witnessed during the monitoring.

Hunting and trapping of birds, together with nestling-theft for selling as cage birds, is the second-most severe threat to the birds. Moreover, illegal harvest of forest fruits, particularly 'chapalish' (*Artocarpus chaplasha*) and 'latkan' (*Bixa* sp.), is a growing threat to the frugivorous birds and mammals.

The above-mentioned threats should be reduced in order to maintain good status of birds. Despite tremendous efforts, the rate of loss of tree cover is still going on in some areas, together with the conversion of lands. The local communities should be motivated and alternative livelihoods (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 these sites must be controlled. The network of poachers and corruptshas to be broken down by making the local young people, conservationists and journalists more aware and vigilant. If these could be done the remaining forests might remain intact, or even improve in the future. However, this is a slow process, so similar projects should continue for longer period of time. The participatory bird monitoring should be repeated in the future in order to assess the overall trend of the condition of these sites over the long-term.

REFERENCES

Ali, S. and Ripley, S.D. 1987. *Compact handbook of the birds of India and Pakistan together with those of Bangladesh, Nepal, Bhutan and Sri Lanka.* Oxford University Press, Delhi. 10 vols.

Bangladesh Forest Department, and Bangladesh Space Research and Remote Sensing Organization 2008. National Forest and Tree Resource Assessment 2005-2007. Bangladesh Forest Department, and Bangladesh Space Research and Remote Sensing Organization, Dhaka, Bangladesh.

Browder, S.F. Johnson, D.H. and Ball, I.J. 2002. Assemblages of breeding birds as indicators of grassland condition. *Ecol. Indicators* **2(2002)**: 257-270.

Buckland, S.T., Anderson, D.R., Burnham, K.P., Laake, J.L., Borchers, D.L. and Thomas, L. 2001. *Introduction to distance sampling: estimating abundance of biological populations.* Oxford University Press, Oxford. 432 pp.

Canterbury, G.E., Martin, T.E. Petit, D.R., Petit, L.J. and Bradford, D.F. 2000. Bird communities and habitat as ecological indicators of forest condition in regional monitoring. *Conserv. Biol.* **14(2)**: 544-558.

Das, A.K., Islam, M.A., Kabir, M.M. and Khan, M.M.H. 2000. The birds of Kuakata of Bangladesh. *Bangladesh Journal of Life Sciences* **12(1&2)**: 35-42.

Grewal, B., Harvey, B. and Pfister, O. 2002. *A photographic guide to the birds of India including Nepal, Sri Lanka, The Maldives, Pakistan, Bangladesh and Bhutan.* Christopher Helm, London. 512 pp.

Grimmett, R., Inskipp, C. and Inskipp, T. 1998. *Birds of the Indian Subcontinent.* Oxford University Press, Delhi. 888 pp.

Harvey, W.G. 1990. *Birds in Bangladesh.* University Press Limited, Dhaka. 188 pp.

Islam, M.A., Khan, M.M.H., Kabir, M.M., Solhoy, T., Joarder, N.B. and Feeroz, M.M. 1999. Birds of the Sundarbans in winter in Bangladesh. *Ecoprint* **6(1)**: 41-49.

IUCN-Bangladesh 2000. *Red book of threatened birds of Bangladesh.* IUCN – The World Conservation Union, Dhaka. 116 pp.

James, F.C., Johnston, R.F., Wamer, N.O., Niemi, G.J. and Beck-len, W.J. 1984. The Grinnellian niche of the Wood Thrush. *Amer. Nat.* **124**: 17-47.

Johnston, D.W., and Odum, E.P. 1956. Breeding bird populations in relation to plant succession on the Piedmont of Georgia. *Ecology* **37**: 50-62.

Kazmierczak, K. 2000. *A Field Guide to the Birds of India, Sri Lanka, Pakistan, Nepal, Bhutan, Bangladesh and the Maldives.* OM Book Service, New Delhi, India. 352 pp.

Khan, M.M.H. 2005. Species diversity, relative abundance and habitat use of the birds in the Sundarbans East Wildlife Sanctuary of Bangladesh. *Forktail* **21(2005)**: 79-86.

Khan, M.M.H. 2008a. *Protected Areas of Bangladesh – A Guide to Wildlife.* Nishorgo Program, Bangladesh Forest Department, Dhaka. 304 pp.

Khan, M.M.H. 2008b. Participatory bird survey to asses Protected Area management impacts. Report submitted to the International Resources Group (IRG), Washington D.C., USA.

Khan, M.M.H. and Aziz, N. 2012. Bird species diversity in five protected areas of Bangladesh. *Forktail* **28(2012)**: 21-28.

Khan, M.M.H., Das, A.K. and Islam, M.A. 1998. Birds in the northern hilly areas of Jamalpur, Sherpur and Netrakona districts of Bangladesh. *Journal of the Asiatic Society of Bangladesh (Sci.)* **24(2)**: 357-361.

Khan, M.M.H. and Islam, M.A. 2000. Status and habitats of the birds of Tangail, Bangladesh. *Bangladesh Journal of Zoology* **28(1)**: 75-88.

MacKinnon, J. and MacKinnon, K. 1986. *Review of the Protected Area System of the Afrotropical Realm.* IUCN – The World Conservation Union, Gland and Cambridge.

Mannan, R.W. and Meslow, E.C. 1984. Bird populations and vegetation characteristics in managed and old-growth forests, northeastern Oregon. *J. Wildl. Manage.* **48**: 1,219-1,238.

Martin, T.E. 1993. Nest predation and nest sites: new perspectives on old patterns. *BioScience* **43**: 523-532.

Martin, T.E. 1995. Avian life history evolution in relation to nest sites, nest predation and food. *Ecol. Monogr.* **65**: 101-127.

Martin, T.E. and Li, P. 1992. Life history traits of open- versus cavity-nesting birds. *Ecology* **73**: 579-592.

Morrison, M.L. 1986. Bird populations as indicators of environmental changes. *Current Ornith.* **3**: 429-451.

Rasmussen, P.C. and Anderton, J.C. 2005. *Birds of South Asia – The Ripley Guide.* Vols 1 and 2. Smithsonian Institute and Lynx Edicions, Washington, D.C., USA, and Barcelona, Spain.

Severinghaus, W.D. 1981. Guild theory development as a mechanism for assessing environmental impacts. *Env. Manage.* **5**: 187-190.

Siddiqui, K.U., Islam, M.A., Kabir, S.M.H., Ahmed, M., Ahmed, A.T.A., Rahman, A.K.A., Haque, E.U. Ahmed, Z.U., Begum, Z.N.T., Hassan, M.A., Khondker, M. and Rahman, M.M. (eds.) 2008. *Encyclopedia of Flora and Fauna of Bangladesh.* Vol. 26: Birds. Asiatic Society of Bangladesh, Dhaka. 662 pp.

Temple, S.A. and Wiens, J.A. 1989. Bird populations and environmental changes: can birds be bio-indicators? *Amer. Birds* **43**: 260-270.

Appendix I. A sample of the data sheet for bird monitoring

ipac	**Integrated Protected Area Co-management (IPAC)** **Participatory Bird Monitoring** to Assess the Protected Area Management Impacts

Name of the Site: ……..
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 Count			**Total Bird Species** (Including indicator species) (Names)	**Miscellaneous Notes** (Any important information recorded at any time while in the field)
Sl. No.	Name	Tally Count		
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Appendix II. List of birds recorded in five New Direct sites of IPAC (Kaptai, Fasiakhali, Medakachapia, Khadimnagar, and Madhupur) during the rainy season of 2009, 2010 and 2012

[N.B. The systematic followed Inskipp et al. (1996)]

ABBREVIATIONS

Principal Diet: o – Omnivore, g – Granivore and Herbivore, f – Frugivore, n – Nectarivore, i – Insectivore, and c – Carnivore (including Piscivore). ***Principal Foraging Guild:*** gr – Ground, b – Bush and Undergrowth, m – Middle Canopy, and u – Upper Canopy. ***Status:*** vc – Very Common, co – Common, uc – Uncommon, and ra – Rare (in study sites); R – Resident, W – Winter Visitor, S – Summer Visitor, and V – Vagrant. ***Distribution:*** WI – Wide (all study sites), KA – Kaptai NP, FA – Fasiakhali WS, ME – Medakachapia NP, KH – Khadimnagar NP, and MA – Madhupur NP.

Sl. No.	English and Scientific Name	Principal Diet	Principal Foraging Guild	Status	Distribution
	ORDER: GALLIFORMES **Family: Phasianidae**				
1	Blue-breasted Quail *Coturnix coromandelica*	g	gr	uc, R	KA, ME
2	White-cheeked Partridge *Arborophila atrogularis* *	g	gr	ra, R	KA
3	Red Junglefowl *Gallus gallus* *	g	gr	co, R	WI
4	Kalij Pheasant *Lophura leucomelanos* *	g	gr	uc, R	KA, KH
5	Grey Peacock Pheasant *Polyplectron bicalcaratum* *	g	gr	ra, R	KA
	ORDER: ANSERIFORMES **Family: Dendrocygnidae**				
6	Lesser Whistling-duck *Dendrocygna javanica* Ψ	g	gr	co, R	KA
	Family: Anatidae				
7	Cotton Pygmy-goose *Nettapus coromandelianus* Ψ	g	gr	ra, R	KA
	ORDER: TURNICIFORMES **Family: Turnicidae**				
8	Barred Buttonquail *Turnix suscitator*	g	gr	uc, R	WI
	ORDER: PICIFORMES **Family: Picidae**				
9	Eurasian Wryneck *Jynx torquila*	i	gr	uc, W	WI
10	Speckled Piculet *Picumnus innominatus**	i	m	ra, R	KA
11	White-browed Piculet *Sasia ochracea* *	i	m	ra, R	KA, KH
12	Rufous Woodpecker *Celeus brachyurus*	i	m	co, R	WI
13	Great Slaty Woodpecker *Mulleripicus pulverulentus* *	i	u	ra, R	KA, FA, ME
14	Grey-capped Pygmy Woodpecker *Dendrocopos canicapillus* *	i	m	uc, R	WI
15	Fulvous-breasted Woodpecker *Dendrocopos macei*	i	m	vc, R	WI
16	Lesser Yellownape *Picus chlorolophus* *	i	u	ra, R	KA, KH
17	Greater Yellownape *Picus flavinucha* *	i	u	co, R	KA, FA, ME, KH
18	Grey-headed Woodpecker *Picus canus*	i	u	ra, R	WI
19	Black-rumped Flameback *Dinopium benghalense*	i	m	vc, R	WI
20	Greater Flameback *Chrysocolaptes lucidus* *	i	u	vc, R	WI
	Family: Megalaimidae				

21	Lineated Barbet *Megalaima lineata*	f	u	vc, R	WI
22	Blue-throated Barbet *Megalaima asiatica*	f	u	vc, R	KA, FA, ME, KH
23	Blue-eared Barbet *Megalaima australis* *	f	u	uc, R	KA, KH
24	Coppersmith barbet *Megalaima haemacephala*	f	m	vc, R	WI
	ORDER: BUCEROTIFORMES **Family: Bucerotidae**				
25	Oriental Pied Hornbill *Anthracoceros albirostris* *	f	u	uc, R	KA
	ORDER: UPUPIFORMES **Family: Upupidae**				
26	Common Hoopoe *Upupa epops*	i	gr	co, R	WI
	ORDER: TROGONIFORMES **Family: Trogonidae**				
27	Red-headed Trogon *Harpactes erythrocephalus* *	i	m	ra, R	KA
	ORDER: CORACIIFORMES **Family: Coraciidae**				
28	Indian Roller *Coracias benghalensis*	i	gr	co, R	WI
29	Dollarbird *Eurystomus orientalis* *	i	u	ra, V	KA
	Family: Alcedinidae				
30	Common Kingfisher *Alcedo atthis*	c	gr (water)	co, R	WI
31	Oriental Dwarf Kingfisher *Ceyx erithacus* *	c	gr (water)	ra, V	KA
	Family: Halcyonidae				
32	White-throated Kingfisher *Halcyon smyrnensis*	c	gr (water)	co, R	WI
	Family: Cerylidae				
33	Pied Kingfisher *Ceryle rudis*	c	gr (water)	ra, R	KA
	Family: Meropidae				
34	Blue-bearded Bee-eater *Nyctyornis athertoni* *	i	u	ra, R	KA, KH, MA
35	Green Bee-eater *Merops orientalis*	i	m	vc, R	WI
36	Blue-tailed Bee-eater *Merops philippinus* *	i	u	co, R	WI
37	Chestnut-headed Bee-eater *Merops leschenaulti* *	i	u	vc, R	WI
	ORDER: CUCULIFORMES **Family: Cuculidae**				
38	Pied Cuckoo *Clamator jacobinus*	i	m	ra, S	WI
39	Chestnut-winged Cuckoo *Clamator coromandus* *	i	m	ra, V	KH
40	Common Hawk Cuckoo *Hierococcyx varius*	i	m	vc, R	WI
41	Indian Cuckoo *Cuculus micropterus*	i	m	co, S	WI
42	Banded Bay Cuckoo *Cacomantis sonneratii**	i	u	ra, R	KA
43	Plaintive Cuckoo *Cacomantis merulinus*	i	m	co, R	WI
44	Violet Cuckoo *Chrysococcyx xanthorhynchus* *	i	m	ra, S	KH
45	Drongo Cuckoo *Surniculus lugubris* *	i	u	co, R	KA, KH
46	Asian Koel *Eudynamys scolopacea*	i	m	vc, R	WI
47	Green-billed Malkoha *Phaenicophaeus tristis* *	i	m	vc, R	WI
	Family: Centropodidae				
48	Greater Coucal *Centropus sinensis*	i	gr	vc, R	WI
49	Lesser Coucal *Centropus bengalensis* *	i	u	co, R	WI
	ORDER: PSITTACIFORMES **Family: Psittacidae**				
50	Vernal Hanging Parrot *Loriculus vernalis* *	g	m	uc, R	KA, FA, ME, KH
51	Alexandrine Parakeet *Psittacula eupatria*	f	u	ra, R	MA
52	Rose-ringed Parakeet *Psittacula krameri*	f	u	co, R	WI
53	Blossom-headed Parakeet *Psittacula roseata* *	f	u	uc, R	KH
54	Plum-headed Parakeet *Psittacula cyanocephala**	f	u	ra, R	MA
55	Grey-headed Parakeet *Psittacula finschii**	f	u	ra, R	KA
56	Red-breasted Parakeet *Psittacula alexandri* *	f	m	vc, R	WI

	ORDER: APODIFORMES				
	Family: Apodidae				
57	Asian Palm Swift *Cypsiurus balasiensis*	i	u (mid-air)	co, R	WI
	ORDER: STRIGIFORMES				
	Family: Strigidae				
58	Oriental Scops Owl *Otus sunia* *	i	m	ra, R	WI
59	Collared Scops Owl *Otus bakkamoena*	i	m	ra, R	WI
60	Mountain Scops Owl *Otus spilocephalus**	i	u	ra, R	KA
61	Spot-bellied Eagle Owl *Bubo nipalensis* *	c	m	ra, R	KA
62	Dusky Eagle Owl *Bubo coromandus* *	c	m	ra, R	MA
63	Brown Fish Owl *Ketupa zeylonensis*	c	m	ra, R	WI
64	Buffy Fish Owl *Ketupa ketupa* *	c	m	ra, R	KA
65	Brown Wood Owl *Strix leptogrammica* *	c	m	ra, R	MA
66	Asian Barred Owlet *Glaucidium cuculoides* *	i	m	co, R	KA, FA, ME, KH
67	Spotted Owlet *Athene brama*	i	m	vc, R	WI
68	Brown Hawk Owl *Ninox scutulata*	i	m	co, R	WI
	Family: Caprimulgidae				
69	Large-tailed Nightjar *Caprimulgus macrurus* *	i	m (mid-air)	co, R	WI
	ORDER: COLUMBIFORMES				
	Family: Columbidae				
70	Rock Pigeon *Columba livia*	g	gr	co, R	WI
71	Green Imperial Pigeon *Ducula aenea* *	f	u	ra, R	KA
72	Oriental Turtle Dove *Streptopelia orientalis* *	g	m	ra, R	KA, FA, ME, KH
73	Spotted Dove *Streptopelia chinensis*	g	gr	vc, R	WI
74	Red Collared Dove *Streptopelia tranquebarica*	g	gr	co, R	WI
75	Eurasian Collared Dove *Streptopelia decaocto*	g	gr	co, R	WI
76	Emerald Dove *Chalcophaps indica* *	g	gr	vc, R	WI
77	Orange-breasted Green Pigeon *Treron bicincta* *	f	m	ra, R	WI
78	Pompadour Green Pigeon *Treron pompadora* *	f	m	co, R	WI
79	Thick-billed Green Pigeon *Treron curvirostra* *	f	m	ra, R	WI
80	Yellow-footed Green Pigeon *Treron phoenicoptera*	f	m	co, R	WI
81	Wedge-tailed Green Pigeon *Treron sphenura* *	f	u	ra, R	KA
82	Pin-tailed Green Pigeon *Treron apicauda**	f	u	ra, R	KA
	ORDER: GRUIFORMES				
	Family: Rallidae				
83	White-breasted Waterhen *Amaurornis phoenicurus*	i	gr	uc, R	WI
84	Slaty-legged Crake *Rallina eurizonoides*	g	gr	ra, W	MA
	ORDER: CICONIIFORMES				
	Family: Scolopacidae				
85	Pintail Snipe *Gallinago stenura*	i	gr	ra, W	WI
86	Common Snipe *Gallinago gallinago*	i	gr	ra, W	WI
87	Green Sandpiper *Tringa ochropus*	i	gr	ra, W	WI
88	Wood Sandpiper *Tringa glareola*	i	gr	co, W	WI
89	Common Sandpiper *Actitis hypoleucos*	i	gr	co, W	WI
	Family: Rostratulidae				
90	Greater Painted Snipe *Rostratula benghalensis*	i	gr	uc, R	WI
	Family: Jacanidae				
91	Bronze-winged Jacana *Metopidius indicus*	g	gr	uc, R	KA, MA
	Family: Charadriidae				
92	Little Ringed Plover *Charadrius dubius*	i	gr	ra, W	KA
93	Red-wattled Lapwing *Vanellus indicus*	i	gr	uc, R	WI
	Family: Laridae				
94	Little Tern *Sterna albifrons*	c	gr (water)	uc, R	KA

95	Whiskered Tern *Chlidonias hybridus*	c	gr (water)	uc, W	KA
	Family: Accipitridae				
96	Osprey *Pandion haliaetus*	c	gr (water)	ra, W	KA
97	Jerdon's Baza *Aviceda jerdoni* *	c	u	ra, R	KA, KH
98	Black Baza *Aviceda leuphotes* *	c	u	uc, R	KA, KH
99	Oriental Honey-buzzard *Pernis ptilorhyncus*	i (while feeding honey-comb)	m	uc, R	WI
100	Black-shouldered Kite *Elanus caeruleus*	i	gr	uc, R	WI
101	Black Kite *Milvus migrans*	c	gr	uc, R	WI
102	Brahminy Kite *Haliastur indus*	c	gr	co, R	WI
103	White-rumped Vulture *Gyps bengalensis*	c (carrion)	gr	uc, R	KH
104	Crested Serpent Eagle *Spilornis cheela* *	c	m	vc, R	WI
105	Shikra *Accipiter badius* *	c	m	uc, R	WI
106	Besra *Accipiter virgatus* *	c	m	uc, R	WI
107	Changeable Hawk Eagle *Spizaetus cirrhatus* *	c	m	ra, R	WI
	Family: Falconidae				
108	Common Kestrel *Falco tinnunculus*	i	gr	uc, W	WI
109	Amur Falcon *Falco amurensis*	i	u (mid-air)	ra, W	KH
110	Eurasian Hobby *Falco subbuteo*	i	u	ra, V	KH, MA
	Family: Phalacrocoracidae				
111	Little Cormorant *Phalacrocorax niger* Ψ	c	gr (water)	ra, R	KA
112	Indian Cormorant *Phalacrocorax fuscicollis*	c	gr (water)	ra, R	KA
113	Great Cormorant *Phalacrocorax carbo*	c	gr (water)	co, R	KA
	Family: Ardeidae				
114	Little Egret *Egretta garzetta*	c	gr	uc, R	WI
115	Great Egret *Casmerodius albus*	c	gr	uc, R	KA
116	Cattle Egret *Bubulcus ibis*	c	gr	uc, R	WI
117	Indian Pond Heron *Ardeola grayii*	c	gr	vc, R	WI
118	Black-crowned Night Heron *Nycticorax nycticorax*	c	gr	ra, R	WI
119	Malayan Night Heron *Gorsachius melanolophus* *	c	gr	ra, V	KA
120	Yellow Bittern *Ixobrychus sinensis*	c	gr	ra, R	KA
121	Cinnamon Bittern *Ixobrychus cinnamomeus*	c	gr	uc, R	KA, MA
	ORDER: PASSERIFORMES **Family: Pittidae**				
122	Blue-naped Pitta *Pitta nipalensis* *	i	gr	ra, R	KA
123	Hooded Pitta *Pitta sordida* *	i	gr	ra, S	KA, KH, MA
124	Indian Pitta *Pitta brachyura*	i	gr	co, S	MA
	Family: Irenidae				
125	Asian Fairy Bluebird *Irena puella* *	f	m	co, R	KA, KH
126	Blue-winged Leafbird *Chloropsis cochinchinensis* *	i	m	ra, R	KA, KH
127	Golden-fronted Leafbird *Chloropsis aurifrons* *	i	m	vc, R	WI
	Family: Eurylaimidae				
128	Silver-breasted Broadbill *Serilophus lunatus**	i	m	ra, R	KA
	Family: Laniidae				
129	Brown Shrike *Lanius cristatus*	i	b	co, W	WI
130	Long-tailed Shrike *Lanius schach*	i	b	co, R	WI
131	Grey-backed Shrike *Lanius tephronotus*	i	b	uc, W	WI
	Family: Corvidae				
132	Common Green Magpie *Cissa chinensis* *	o	m	ra, R	KA, KH
133	Rufous Treepie *Dendrocitta vagabunda*	o	m	co, R	WI
134	Grey Treepie *Dendrocitta formosae* *	o	m	uc, R	KH
135	House Crow *Corvus splendens*	o	gr	uc, R	WI

136	Large-billed Crow *Corvus macrorhynchos*	o	gr	co, R	WI
137	Ashy Woodswallow *Artamus fuscus*	i	u (mid-air)	uc, R	WI
138	Black-naped Oriole *Oriolus chinensis* *	o	m	ra, W	KA, FA, ME, KH
139	Black-hooded Oriole *Oriolus xanthornus*	o	m	vc, R	WI
140	Large Cuckooshrike *Coracina macei*	o	m	co, R	WI
141	Black-winged Cuckooshrike *Coracina melaschistos* *	o	m	ra, W	WI
142	Black-headed Cuckooshrike *Coracina melanoptera*	o	m	ra, R	WI
143	Rosy Minivet *Pericrocotus roseus* *	i	u	ra, R	WI
144	Ashy Minivet *Pericrocotus divaricatus* *	i	u	ra, R	KH, MA
145	Small Minivet *Pericrocotus cinnamomeus* *	i	u	vc, R	WI
146	Scarlet Minivet *Pericrocotus flammeus* *	i	u	co, R	WI
147	Bar-winged Flycatcher-shrike *Hemipus picatus* *	i	m	uc, R	KH
148	White-throated Fantail *Rhipidura albicollis*	i	b	co, R	WI
149	Black Drongo *Dicrurus macrocercus*	i	m	vc, R	WI
150	Ashy Drongo *Dicrurus leucophaeus*	i	m	ra, W	WI
151	Bronzed Drongo *Dicrurus aeneus* *	i	m	vc, R	WI
152	Lesser Racket-tailed Drongo *Dicrurus remifer* *	i	u	ra, W	MA
153	Spangled Drongo *Dicrurus hottentottus* *	i	m	co, R	WI
154	Greater Racket-tailed Drongo *Dicrurus paradiseus* *	i	u	co, R	KA, FA, ME, KH
155	Black-naped Monarch *Hypothymis azurea* *	i	b	co, R	WI
156	Common Iora *Aegithina tiphia*	i	m	vc, R	WI
157	Large Woodshrike *Tephrodornis gularis* *	i	u	co, R	KH
158	Common Woodshrike *Tephrodornis pondicerianus* *	i	m	co, R	WI
	Family: Muscicapidae				
159	Blue Rock Thrush *Monticola solitarius*	i	gr	uc, W	WI
160	Blue Whistling Thrush *Myophonus caeruleus* *	i	gr	ra, R	KA
161	Orange-headed Thrush *Zoothera citrina*	i	gr	ra, R	WI
162	Red-throated Flycatcher *Ficedula parva*	i	m	vc, W	WI
163	Verditer Flycatcher *Eumyias thalassina* *	i	u	uc, W	WI
164	Pale-chinned Flycatcher *Cyornis poliogenys* *	i	m	ra, R	WI
165	Grey-headed Canary Flycatcher *Culicicapa ceylonensis*	i	m	co, R	WI
166	Oriental Magpie Robin *Copsychus saularis*	i	gr	vc, R	WI
167	White-rumped Shama *Copsychus malabaricus* *	i	gr	co, R	WI
168	Black Redstart *Phoenicurus ochruros*	i	b	ra, W	WI
169	Black-backed Forktail *Enicurus immaculatus* *	i	gr	ra, R	KA
170	Common Stonechat *Saxicola torquata*	i	b	co, W	WI
171	Pied Bushchat *Saxicola caprata*	i	b	ra, R	KA
	Family: Sturnidae				
172	Asian Glossy Starling *Aplonis panayensis* *	f	m	ra, W	KA
173	Chestnut-tailed Starling *Sturnus malabaricus*	f	m	vc, R	WI
174	Purple-backed Starling *Sturnus sturninus*	o	gr	ra, V	MA
175	Asian Pied Starling *Sturnus contra*	o	gr	vc, R	WI
176	Common Myna *Acridotheres tristis*	o	gr	vc, R	WI
177	Bank Myna *Acridotheres ginginianus*	o	gr	ra, R	WI
178	Jungle Myna *Acridotheres fuscus*	o	m	vc, R	WI
179	Hill Myna *Gracula religiosa* *	o	u	co, R	KA, FA, ME, KH
	Family: Sittidae				
180	Velvet-fronted Nuthatch *Sitta frontalis* *	i	m	uc, R	WI
	Family: Paridae				
181	Great Tit *Parus major*	i	m	vc, R	WI

	Family: Hirundinidae				
182	Barn Swallow *Hirundo rustica*	i	u (mid-air)	co, W	WI
	Family: Pycnonotidae				
183	Black-headed Bulbul *Pycnonotus atriceps* *	o	m	uc, R	WI
184	Black-crested Bulbul *Pycnonotus melanicterus* *	o	m	co, R	WI
185	Red-whiskered Bulbul *Pycnonotus jocosus*	o	m	vc, R	WI
186	Red-vented Bulbul *Pycnonotus cafer*	o	m	vc, R	WI
187	White-throated Bulbul *Alophoixus flaveolus* *	o	m	co, R	WI
188	Olive Bulbul *Iole virescens* *	o	m	ra, R	KA
189	Ashy Bulbul *Hemixos flavala* *	o	m	ra, R	KA
	Family: Cisticolidae				
190	Grey-breasted Prinia *Prinia hodgsonii*	i	b	co, R	WI
191	Plain Prinia *Prinia inornata*	i	b	uc, R	WI
192	Zitting Cisticola *Cisticola juncidis*	i	b	co, R	WI
	Family: Zosteropidae				
193	Oriental White-eye *Zosterops palpebrosus*	i	m	vc, R	WI
	Family: Sylviidae				
194	Blyth's Reed Warbler *Acrocephalus dumetorum*	i	b	co, W	WI
195	Striated Grassbird *Megalurus palustris*	i	b	uc, R	KA
196	Common Tailorbird *Orthotomus sutorius*	i	b	vc, R	WI
197	Dark-necked Tailorbird *Orthotomus atrogularis* *	i	b	uc, R	KA
198	Dusky Warbler *Phylloscopus fuscatus*	i	b	uc, W	WI
199	Tickell's Leaf Warbler *Phylloscopus affinis*	i	m	uc, W	WI
200	Yellow-browed Warbler *Phylloscopus inornatus*	i	m	co, W	WI
201	Greenish Warbler *Phylloscopus trochiloides*	i	m	uc, W	WI
202	Blyth's Leaf Warbler *Phylloscopus reguloides*	i	m	uc, W	WI
203	Yellow-vented Warbler *Phylloscopus cantator*	i	m	uc, W	KA
204	Golden-spectacled Warbler *Seicercus burkii*	i	m	ra, S	MA
205	Grey-hooded Warbler *Seicercus xanthoschistos*	i	m	ra, W	KH
206	White-crested Laughingthrush *Garrulax leucolophus* *	i	b	ra, R	KA, ME
207	Lesser Necklaced Laughingthrush *Garrulax moniliger* *	i	m	ra, R	KA, FA, ME, KH
208	Greater Necklaced Laughingthrush *Garrulax pectoralis* *	i	m	co, R	KA, FA, ME, KH
209	Rufous-necked Laughingthrush *Garrulax ruficollis* *	i	b	co, R	WI
210	Abbott's Babbler *Malacocincla abbotti* *	i	b	vc, R	WI
211	Puff-throated Babbler *Pellorneum ruficeps* *	i	b	co, R	WI
212	Large Scimitar Babbler *Pomatorhinus hypoleucos* *	i	m	ra, R	KA
213	White-browed Scimitar Babbler *Pomatorhinus schisticeps* *	i	b	ra, R	KA, KH
214	Grey-throated Babbler *Stachyris nigriceps* *	i	b	ra, R	KA, FA, ME
215	Striped Tit Babbler *Macronous gularis* *	i	b	co, R	WI
216	Chestnut-capped Babbler *Timalia pileata* *	i	b	ra, R	KA, FA, ME, KH
217	Yellow-eyed Babbler *Chrysomma sinensis* *	i	b	ra, R	KA
218	White-hooded Babbler *Gampsorhynchus rufulus**	i	b	ra, R	KA
219	White-bellied Yuhina *Yuhina zantholeuca**	i	m	ra, R	KA
220	Brown-cheeked Fulvetta *Alcippe poioicephala* *	i	m	ra, R	KA
221	Nepal Fulvetta *Alcippe nipalensis* *	i	m	ra, R	KA
	Family: Alaudidae				
222	Rufous-winged Bushlark *Mirafra assamica*	g	gr	co, R	WI
	Family: Nectariniidae				
223	Thick-billed Flowerpecker *Dicaeum agile*	o	m	uc, R	WI

224	Yellow-vented Flowerpecker *Dicaeum chrysorrheum* *	o	m	ra, R	KA
225	Orange-bellied Flowerpecker *Dicaeum trigonostigma* *	o	m	ra, R	KA
226	Pale-billed Flowerpecker *Dicaeum erythrorynchos*	o	m	co, R	WI
227	Plain Flowerpecker *Dicaeum concolor*	o	m	co, R	WI
228	Scarlet-backed Flowerpecker *Dicaeum cruentatum* *	o	m	vc, R	WI
229	Ruby-cheeked Sunbird *Anthreptes singalensis* *	n	m	uc, R	WI
230	Purple-rumped Sunbird *Nectarinia zeylonica*	n	m	uc, R	WI
231	Purple-throated Sunbird *Nectarinia sperata* *	n	m	co, R	KA, FA, ME, KH
232	Purple Sunbird *Nectarinia asiatica*	n	m	vc, R	WI
233	Crimson Sunbird *Aethopyga siparaja* *	n	m	vc, R	WI
234	Little Spiderhunter *Arachnothera longirostra* *	n	m	vc, R	WI
235	Streaked Spiderhunter *Arachnothera magna* *	n	m	ra, R	KA
	Family: Passeridae				
236	House Sparrow *Passer domesticus*	g	gr	co, R	WI
237	Forest Wagtail *Dendronanthus indicus* *	i	gr	co, W	WI
238	White Wagtail *Motacilla alba*	i	gr	co, W	WI
239	White-browed Wagtail *Motacilla maderaspatensis*	i	gr	co, R	WI
240	Citrine Wagtail *Motacilla citreola*	i	gr	ra, W	WI
241	Grey Wagtail *Motacilla cinerea*	i	gr	uc, W	WI
242	Paddyfield Pipit *Anthus ruficollis*	i	gr	co, R	WI
243	Olive-backed Pipit *Anthus hodgsoni* *	i	gr	co, W	WI
244	Rosy Pipit *Anthus roseatus*	i	gr	ra, W	KH
245	Baya Weaver *Ploceus philippinus*	i	gr	co, R	WI
246	Indian Silverbill *Lonchura malabarica*	g	gr	ra, R	WI
247	White-rumped Munia *Lonchura striata* *	g	gr	uc, R	WI
248	Scaly-breasted Munia *Lonchura punctulata*	g	gr	co, R	WI
249	Black-headed Munia *Lonchura malacca*	g	gr	ra, R	WI

* Primarily forest species.

Ψ Mainly trespassing species.

Appendix III. List of birds recorded in five Existing Direct sites of IPAC (Lawachara, Satchari, Rema-Kalenga, Chunati and Teknaf) during the rainy season of 2005, 2006, 2007, 2008 and 2012

[N.B. The systematic followed Inskipp et al. (1996)]

ABBREVIATIONS

Principal Diet: o – Omnivore, g – Granivore and Herbivore, f – Frugivore, n – Nectarivore, i – Insectivore, and c – Carnivore (including Piscivore). ***Principal Foraging Guild:*** gr – Ground, b – Bush and Undergrowth, m – Middle Canopy, and u – Upper Canopy. ***Status:*** vc – Very Common, co – Common, uc – Uncommon, and ra – Rare (in NSP sites); R – Resident, W – Winter Visitor, S – Summer Visitor, and V – Vagrant. ***Distribution:*** WI – Wide (all NSP sites), L – Lawachara National Park, S – Satchari National Park, RK – Rema-Kalenga Wildlife Sanctuary, C – Chunati Wildlife Sanctuary, and T – Teknaf Game Reserve.

Sl. No.	English and Scientific Name	Principal Diet	Principal Foraging Guild	Status	Distribution
	ORDER: GALLIFORMES **Family: Phasianidae**				
1	Blue-breasted Quail *Coturnix coromandelica*	g	gr	uc, R	C, T, RK
2	White-cheeked Partridge *Arborophila atrogularis* *	g	gr	ra, R	L, S, RK
3	Red Junglefowl *Gallus gallus* *	g	gr	co, R	WI
4	Kalij Pheasant *Lophura leucomelanos* *	g	gr	uc, R	WI
5	Grey Peacock Pheasant *Polyplectron bicalcaratum* *	g	gr	ra, R	T, RK
	ORDER: ANSERIFORMES **Family: Dendrocygnidae**				
6	Lesser Whistling-duck *Dendrocygna javanica* Ψ	g	gr	co, R	T, RK, C
	Family: Anatidae				
7	Cotton Pygmy-goose *Nettapus coromandelianus* Ψ	g	gr	ra, R	T
	ORDER: TURNICIFORMES **Family: Turnicidae**				
8	Barred Buttonquail *Turnix suscitator*	g	gr	uc, R	C, T, RK
	ORDER: PICIFORMES **Family: Picidae**				
9	Eurasian Wryneck *Jynx torquila*	i	gr	uc, W	C, T, RK
10	White-browed Piculet *Sasia ochracea* *	i	m	ra, R	S, RK
11	Rufous Woodpecker *Celeus brachyurus*	i	m	co, R	WI
12	Great Slaty Woodpecker *Mulleripicus pulverulentus* *	i	u	ra, R	T, C
13	Grey-capped Pygmy Woodpecker *Dendrocopos canicapillus* *	i	m	uc, R	WI
14	Fulvous-breasted Woodpecker *Dendrocopos macei*	i	m	vc, R	WI
15	Lesser Yellownape *Picus chlorolophus* *	i	u	ra, R	L, C
16	Greater Yellownape *Picus flavinucha* *	i	u	co, R	WI
17	Grey-headed Woodpecker *Picus canus*	i	u	ra, R	L, S
18	Black-rumped Flameback *Dinopium benghalense*	i	m	vc, R	WI
19	Greater Flameback *Chrysocolaptes lucidus* *	i	u	vc, R	WI

	Family: Megalaimidae				
20	Lineated Barbet *Megalaima lineata*	f	u	vc, R	WI
21	Blue-throated Barbet *Megalaima asiatica*	f	u	vc, R	WI
22	Blue-eared Barbet *Megalaima australis* *	f	u	uc, R	L, S, RK, T
23	Coppersmith barbet *Megalaima haemacephala*	f	m	vc, R	WI
	ORDER: BUCEROTIFORMES **Family: Bucerotidae**				
24	Oriental Pied Hornbill *Anthracoceros albirostris* *	f	u	uc, R	L, S, RK, T
	ORDER: UPUPIFORMES **Family: Upupidae**				
25	Common Hoopoe *Upupa epops*	i	gr	co, R	C, T, RK
	ORDER: TROGONIFORMES **Family: Trogonidae**				
26	Red-headed Trogon *Harpactes erythrocephalus* *	i	m	ra, R	L, S, RK, T
	ORDER: CORACIIFORMES **Family: Coraciidae**				
27	Indian Roller *Coracias benghalensis*	i	gr	co, R	C, T, RK
28	Dollarbird *Eurystomus orientalis* *	i	u	ra, V	L, S, RK, T
	Family: Alcedinidae				
29	Common Kingfisher *Alcedo atthis*	c	gr (water)	co, R	WI
30	Oriental Dwarf Kingfisher *Ceyx erithacus* *	c	gr (water)	ra, V	L, S
	Family: Halcyonidae				
31	White-throated Kingfisher *Halcyon smyrnensis*	c	gr (water)	co, R	WI
	Family: Cerylidae				
32	Pied Kingfisher *Ceryle rudis*	c	gr (water)	ra, R	T
	Family: Meropidae				
33	Blue-bearded Bee-eater *Nyctyornis athertoni* *	i	u	ra, R	WI
34	Green Bee-eater *Merops orientalis*	i	m	vc, R	WI
35	Blue-tailed Bee-eater *Merops philippinus* *	i	u	co, R	WI
36	Chestnut-headed Bee-eater *Merops leschenaulti* *	i	u	vc, R	WI
	ORDER: CUCULIFORMES **Family: Cuculidae**				
37	Pied Cuckoo *Clamator jacobinus*	i	m	ra, S	WI
38	Chestnut-winged Cuckoo *Clamator coromandus* *	i	m	ra, V	L, S, RK
39	Common Hawk Cuckoo *Hierococcyx varius*	i	m	vc, R	WI
40	Indian Cuckoo *Cuculus micropterus*	i	m	co, S	WI
41	Plaintive Cuckoo *Cacomantis merulinus*	i	m	co, R	WI
42	Asian Emerald Cuckoo *Chrysococcyx maculatus* *	i	m	ra, S	S
43	Violet Cuckoo *Chrysococcyx xanthorhynchus* *	i	m	ra, S	S
44	Drongo Cuckoo *Surniculus lugubris* *	i	u	co, R	L, S, RK, T
45	Asian Koel *Eudynamys scolopacea*	i	m	vc, R	WI
46	Green-billed Malkoha *Phaenicophaeus tristis* *	i	m	vc, R	WI
	Family: Centropodidae				
47	Greater Coucal *Centropus sinensis*	i	gr	vc, R	WI
48	Lesser Coucal *Centropus bengalensis* *	i	u	co, R	WI
	ORDER: PSITTACIFORMES **Family: Psittacidae**				
49	Vernal Hanging Parrot *Loriculus vernalis* *	g	m	uc, R	L, S, RK, T
50	Rose-ringed Parakeet *Psittacula krameri*	f	u	co, R	WI
51	Blossom-headed Parakeet *Psittacula roseata* *	f	u	uc, R	L, S, RK
52	Red-breasted Parakeet *Psittacula alexandri* *	f	m	vc, R	WI
	ORDER: APODIFORMES **Family: Apodidae**				
53	Asian Palm Swift *Cypsiurus balasiensis*	i	u (mid-air)	co, R	C, T, RK

54	Fork-tailed Swift *Apus pacificus*	i	u (mid-air)	ra, W	T
	ORDER: STRIGIFORMES				
	Family: Strigidae				
55	Oriental Scops Owl *Otus sunia* *	i	m	ra, R	L, S, RK
56	Collared Scops Owl *Otus bakkamoena*	i	m	ra, R	WI
57	Spot-bellied Eagle Owl *Bubo nipalensis* *	c	m	ra, R	T
58	Dusky Eagle Owl *Bubo coromandus* *	c	m	ra, R	RK
59	Brown Fish Owl *Ketupa zeylonensis*	c	m	ra, R	WI
60	Tawny Fish Owl *Ketupa flavipes* *	c	m	ra, R	RK, T
61	Brown Wood Owl *Strix leptogrammica* *	c	m	ra, R	L, RK
62	Asian Barred Owlet *Glaucidium cuculoides* *	i	m	co, R	WI
63	Spotted Owlet *Athene brama*	i	m	vc, R	WI
64	Brown Hawk Owl *Ninox scutulata*	i	m	co, R	WI
	Family: Caprimulgidae				
65	Large-tailed Nightjar *Caprimulgus macrurus* *	i	m (mid-air)	co, R	WI
	ORDER: COLUMBIFORMES				
	Family: Columbidae				
66	Rock Pigeon *Columba livia*	g	gr	co, R	WI
67	Green Imperial Pigeon *Ducula aenea* *	f	u	ra, R	L, S, RK
68	Oriental Turtle Dove *Streptopelia orientalis* *	g	m	ra, R	L, S, RK
69	Spotted Dove *Streptopelia chinensis*	g	gr	vc, R	WI
70	Red Collared Dove *Streptopelia tranquebarica*	g	gr	co, R	WI
71	Eurasian Collared Dove *Streptopelia decaocto*	g	gr	co, R	WI
72	Barred Cuckoo Dove *Macropygia unchall* *	g	m	ra, R	S
73	Emerald Dove *Chalcophaps indica* *	g	gr	vc, R	WI
74	Orange-breasted Green Pigeon *Treron bicincta* *	f	m	ra, R	L, S, RK
75	Pompadour Green Pigeon *Treron pompadora* *	f	m	co, R	WI
76	Thick-billed Green Pigeon *Treron curvirostra* *	f	m	ra, R	L, S, RK
77	Yellow-footed Green Pigeon *Treron phoenicoptera*	f	m	co, R	WI
78	Wedge-tailed Green Pigeon *Treron sphenura* *	f	u	ra, R	L, S, RK
	ORDER: GRUIFORMES				
	Family: Rallidae				
79	White-breasted Waterhen *Amaurornis phoenicurus*	i	gr	uc, R	RK, C, T
	ORDER: CICONIIFORMES				
	Family: Scolopacidae				
80	Pintail Snipe *Gallinago stenura*	i	gr	ra, W	RK, C, T
81	Common Snipe *Gallinago gallinago*	i	gr	ra, W	RK, C, T
82	Green Sandpiper *Tringa ochropus*	i	gr	ra, W	RK, C, T
83	Wood Sandpiper *Tringa glareola*	i	gr	co, W	RK, C, T
84	Common Sandpiper *Actitis hypoleucos*	i	gr	co, W	RK, C, T
	Family: Rostratulidae				
85	Greater Painted Snipe *Rostratula benghalensis*	i	gr	uc, R	RK, C, T
	Family: Jacanidae				
86	Bronze-winged Jacana *Metopidius indicus*	g	gr	uc, R	C
	Family: Charadriidae				
87	Little Ringed Plover *Charadrius dubius*	i	gr	ra, W	C
88	Red-wattled Lapwing *Vanellus indicus*	i	gr	uc, R	RK, C, T
	Family: Laridae				
89	Little Tern *Sterna albifrons*	c	gr (water)	uc, R	T
90	Whiskered Tern *Chlidonias hybridus*	c	gr (water)	uc, W	T
	Family: Accipitridae				
91	Osprey *Pandion haliaetus*	c	gr (water)	ra, W	T
92	Jerdon's Baza *Aviceda jerdoni* *	c	u	ra, R	L, S, RK
93	Black Baza *Aviceda leuphotes* *	c	u	uc, R	L, S, RK, T
94	Oriental Honey-buzzard *Pernis ptilorhyncus*	i (while	m	uc, R	W

		feeding honey-comb)			
95	Black-shouldered Kite *Elanus caeruleus*	i	gr	uc, R	C, T, RK
96	Black Kite *Milvus migrans*	c	gr	uc, R	C, T, RK, S
97	Brahminy Kite *Haliastur indus*	c	gr	co, R	WI
98	White-rumped Vulture *Gyps bengalensis*	c (carrion)	gr	uc, R	RK, C, T
99	Himalayan Griffon *Gyps himalayensis*	c (carrion)	gr	ra, V	RK
100	Crested Serpent Eagle *Spilornis cheela* *	c	m	vc, R	WI
101	Shikra *Accipiter badius* *	c	m	uc, R	WI
102	Besra *Accipiter virgatus* *	c	m	uc, R	WI
103	Changeable Hawk Eagle *Spizaetus cirrhatus* *	c	m	ra, R	L, S, RK
	Family: Falconidae				
104	Common Kestrel *Falco tinnunculus*	i	gr	uc, W	WI
105	Amur Falcon *Falco amurensis*	i	u (mid-air)	ra, W	L, RK
	Family: Phalacrocoracidae				
106	Little Cormorant *Phalacrocorax niger* Ψ	c	gr (water)	ra, R	T
	Family: Ardeidae				
107	Little Egret *Egretta garzetta*	c	gr	uc, R	C, T, RK
108	Cattle Egret *Bubulcus ibis*	c	gr	uc, R	C, T, RK
109	Indian Pond Heron *Ardeola grayii*	c	gr	vc, R	C, T, RK, L
110	Black-crowned Night Heron *Nycticorax nycticorax*	c	gr	ra, R	RK, C, T
111	Malayan Night Heron *Gorsachius melanolophus* *	c	gr	ra, V	L, RK
112	Yellow Bittern *Ixobrychus sinensis*	c	gr	ra, R	T, C
113	Cinnamon Bittern *Ixobrychus cinnamomeus*	c	gr	uc, R	RK, C, T
	Family: Ciconiidae				
114	Asian Openbill *Anastomus oscitans*	c (snail)	gr	ra, R	RK
115	Lesser Adjutant *Leptoptilos javanicus*	c	gr	ra, R	RK
	ORDER: PASSERIFORMES **Family: Pittidae**				
116	Blue-naped Pitta *Pitta nipalensis* *	i	gr	ra, R	RK, L, S, T
117	Hooded Pitta *Pitta sordida* *	i	gr	ra, S	S, L, RK
	Family: Irenidae				
118	Asian Fairy Bluebird *Irena puella* *	f	m	co, R	L, S, RK, T
119	Blue-winged Leafbird *Chloropsis cochinchinensis* *	i	m	ra, R	L, T
120	Golden-fronted Leafbird *Chloropsis aurifrons* *	i	m	vc, R	WI
	Family: Laniidae				
121	Brown Shrike *Lanius cristatus*	i	b	co, W	WI
122	Long-tailed Shrike *Lanius schach*	i	b	co, R	WI
123	Grey-backed Shrike *Lanius tephronotus*	i	b	uc, W	WI
	Family: Corvidae				
124	Common Green Magpie *Cissa chinensis* *	o	m	ra, R	S, L, T
125	Rufous Treepie *Dendrocitta vagabunda*	o	m	co, R	WI
126	Grey Treepie *Dendrocitta formosae* *	o	m	uc, R	L, S, RK, T
127	House Crow *Corvus splendens*	o	gr	uc, R	C, T, RK
128	Large-billed Crow *Corvus macrorhynchos*	o	gr	co, R	WI
129	Ashy Woodswallow *Artamus fuscus*	i	u (mid-air)	uc, R	WI
130	Black-naped Oriole *Oriolus chinensis* *	o	m	ra, W	L, S, RK
131	Black-hooded Oriole *Oriolus xanthornus*	o	m	vc, R	WI
132	Maroon Oriole *Oriolus traillii* *	o	u	ra, R	L, S, RK
133	Large Cuckooshrike *Coracina macei*	o	m	co, R	WI
134	Black-winged Cuckooshrike *Coracina melaschistos* *	o	m	ra, W	L, S, RK
135	Black-headed Cuckooshrike *Coracina melanoptera*	o	m	ra, R	RK

136	Rosy Minivet *Pericrocotus roseus* *	i	u	ra, R	L, S, RK
137	Ashy Minivet *Pericrocotus divaricatus* *	i	u	ra, R	L, RK
138	Small Minivet *Pericrocotus cinnamomeus* *	i	u	vc, R	WI
139	Scarlet Minivet *Pericrocotus flammeus* *	i	u	co, R	WI
140	Bar-winged Flycatcher-shrike *Hemipus picatus* *	i	m	uc, R	L, S, RK
141	White-throated Fantail *Rhipidura albicollis*	i	b	co, R	WI
142	Black Drongo *Dicrurus macrocercus*	i	m	vc, R	WI
143	Ashy Drongo *Dicrurus leucophaeus*	i	m	ra, W	WI
144	Bronzed Drongo *Dicrurus aeneus* *	i	m	vc, R	WI
145	Lesser Racket-tailed Drongo *Dicrurus remifer* *	i	u	ra, W	L, S, RK
146	Spangled Drongo *Dicrurus hottentottus* *	i	m	co, R	WI
147	Greater Racket-tailed Drongo *Dicrurus paradiseus* *	i	u	co, R	WI
148	Black-naped Monarch *Hypothymis azurea* *	i	b	co, R	WI
149	Common Iora *Aegithina tiphia*	i	m	vc, R	WI
150	Large Woodshrike *Tephrodornis gularis* *	i	u	co, R	L, S, RK
151	Common Woodshrike *Tephrodornis pondicerianus* *	i	m	co, R	WI
	Family: Muscicapidae				
152	Blue Rock Thrush *Monticola solitarius*	i	gr	uc, W	WI
153	Blue Whistling Thrush *Myophonus caeruleus* *	i	gr	ra, R	T
154	Orange-headed Thrush *Zoothera citrina*	i	gr	ra, R	WI
155	Red-throated Flycatcher *Ficedula parva*	i	m	vc, W	WI
156	Verditer Flycatcher *Eumyias thalassina* *	i	u	uc, W	WI
157	Pale-chinned Flycatcher *Cyornis poliogenys* *	i	m	ra, R	RK, L, S
158	Grey-headed Canary Flycatcher *Culicicapa ceylonensis*	i	m	c, R	WI
159	Oriental Magpie Robin *Copsychus saularis*	i	gr	vc, R	WI
160	White-rumped Shama *Copsychus malabaricus* *	i	gr	co, R	WI
161	Black Redstart *Phoenicurus ochruros*	i	b	ra, W	RK, C, T
162	Black-backed Forktail *Enicurus immaculatus* *	i	gr	ra, R	RK, T
163	Common Stonechat *Saxicola torquata*	i	b	co, W	RK, C, T
164	Pied Bushchat *Saxicola caprata*	i	b	ra, R	C, T
	Family: Sturnidae				
165	Asian Glossy Starling *Aplonis panayensis* *	f	m	ra, W	T
166	Chestnut-tailed Starling *Sturnus malabaricus*	f	m	vc, R	WI
167	Asian Pied Starling *Sturnus contra*	o	gr	vc, R	WI
168	Common Myna *Acridotheres tristis*	o	gr	vc, R	WI
169	Bank Myna *Acridotheres ginginianus*	o	gr	ra, R	RK, C, T
170	Jungle Myna *Acridotheres fuscus*	o	m	vc, R	WI
171	Hill Myna *Gracula religiosa* *	o	u	co, R	WI
	Family: Sittidae				
172	Velvet-fronted Nuthatch *Sitta frontalis* *	i	m	uc, R	RK, L, S
	Family: Paridae				
173	Great Tit *Parus major*	i	m	vc, R	WI
	Family: Hirundinidae				
174	Barn Swallow *Hirundo rustica*	i	u (mid-air)	co, W	WI
	Family: Pycnonotidae				
175	Black-headed Bulbul *Pycnonotus atriceps* *	o	m	uc, R	WI
176	Black-crested Bulbul *Pycnonotus melanicterus* *	o	m	co, R	WI
177	Red-whiskered Bulbul *Pycnonotus jocosus*	o	m	vc, R	WI
178	Red-vented Bulbul *Pycnonotus cafer*	o	m	vc, R	WI
179	White-throated Bulbul *Alophoixus flaveolus* *	o	m	co, R	WI
180	Olive Bulbul *Iole virescens* *	o	m	ra, R	RK, L, S
181	Ashy Bulbul *Hemixos flavala* *	o	m	ra, R	L, RK
	Family: Cisticolidae				
182	Grey-breasted Prinia *Prinia hodgsonii*	i	b	co, R	WI

183	Plain Prinia *Prinia inornata*	i	b	uc, R	C, T, RK
184	Zitting Cisticola *Cisticola juncidis*	i	b	co, R	WI
	Family: Zosteropidae				
185	Oriental White-eye *Zosterops palpebrosus*	i	m	vc, R	WI
	Family: Sylviidae				
186	Blyth's Reed Warbler *Acrocephalus dumetorum*	i	b	co, W	WI
187	Striated Grassbird *Megalurus palustris*	i	b	uc, R	C, T
188	Common Tailorbird *Orthotomus sutorius*	i	b	vc, R	WI
189	Dark-necked Tailorbird *Orthotomus atrogularis* *	i	b	uc, R	T, C
190	Dusky Warbler *Phylloscopus fuscatus*	i	b	uc, W	WI
191	Tickell's Leaf Warbler *Phylloscopus affinis*	i	m	uc, W	WI
192	Yellow-browed Warbler *Phylloscopus inornatus*	i	m	co, W	WI
193	Greenish Warbler *Phylloscopus trochiloides*	i	m	uc, W	WI
194	Blyth's Leaf Warbler *Phylloscopus reguloides*	i	m	uc, W	L, S, RK
195	Yellow-vented Warbler *Phylloscopus cantator*	i	m	uc, W	L, RK
196	Golden-spectacled Warbler *Seicercus burkii*	i	m	ra, S	L, RK
197	Grey-hooded Warbler *Seicercus xanthoschistos*	i	m	ra, W	L, RK
198	White-crested Laughingthrush *Garrulax leucolophus* *	i	b	ra, R	C, T
199	Lesser Necklaced Laughingthrush *Garrulax moniliger* *	i	m	ra, R	RK, L, C
200	Greater Necklaced Laughingthrush *Garrulax pectoralis* *	i	m	co, R	WI
201	Rufous-necked Laughingthrush *Garrulax ruficollis* *	i	b	co, R	WI
202	Abbott's Babbler *Malacocincla abbotti* *	i	b	vc, R	WI
203	Puff-throated Babbler *Pellorneum ruficeps* *	i	b	co, R	WI
204	Large Scimitar Babbler *Pomatorhinus hypoleucos* *	i	m	ra, R	L, RK, T
205	White-browed Scimitar Babbler *Pomatorhinus schisticeps* *	i	b	ra, R	L, S, RK
206	Grey-throated Babbler *Stachyris nigriceps* *	i	b	ra, R	C, T
207	Striped Tit Babbler *Macronous gularis* *	i	b	co, R	WI
208	Chestnut-capped Babbler *Timalia pileata* *	i	b	ra, R	C, T
209	Yellow-eyed Babbler *Chrysomma sinensis* *	i	b	ra, R	C, T
210	Brown-cheeked Fulvetta *Alcippe poioicephala* *	i	m	ra, R	L
211	Nepal Fulvetta *Alcippe nipalensis* *	i	m	ra, R	RK
	Family: Alaudidae				
212	Rufous-winged Bushlark *Mirafra assamica*	g	gr	co, R	WI
	Family: Nectariniidae				
213	Thick-billed Flowerpecker *Dicaeum agile*	o	m	uc, R	RK, C, T
214	Yellow-vented Flowerpecker *Dicaeum chrysorrheum* *	o	m	ra, R	L, RK, T
215	Orange-bellied Flowerpecker *Dicaeum trigonostigma* *	o	m	ra, R	T
216	Pale-billed Flowerpecker *Dicaeum erythrorynchos*	o	m	co, R	WI
217	Plain Flowerpecker *Dicaeum concolor*	o	m	co, R	L, RK, T
218	Scarlet-backed Flowerpecker *Dicaeum cruentatum* *	o	m	vc, R	WI
219	Ruby-cheeked Sunbird *Anthreptes singalensis* *	n	m	uc, R	WI
220	Purple-rumped Sunbird *Nectarinia zeylonica*	n	m	uc, R	RK, L, C, T
221	Purple-throated Sunbird *Nectarinia sperata* *	n	m	co, R	WI
222	Purple Sunbird *Nectarinia asiatica*	n	m	vc, R	WI
223	Crimson Sunbird *Aethopyga siparaja* *	n	m	vc, R	WI
224	Little Spiderhunter *Arachnothera longirostra* *	n	m	vc, R	WI
225	Streaked Spiderhunter *Arachnothera magna* *	n	m	ra, R	T

	Family: Passeridae				
226	House Sparrow *Passer domesticus*	g	gr	co, R	WI
227	Forest Wagtail *Dendronanthus indicus* *	i	gr	co, W	WI
228	White Wagtail *Motacilla alba*	i	gr	co, W	RK, L, C, T
229	White-browed Wagtail *Motacilla maderaspatensis*	i	gr	co, R	RK, L, C, T
230	Citrine Wagtail *Motacilla citreola*	i	gr	ra, W	RK, C, T
231	Grey Wagtail *Motacilla cinerea*	i	gr	uc, W	RK, C, T
232	Paddyfield Pipit *Anthus ruficollis*	i	gr	co, R	RK, C, T
233	Olive-backed Pipit *Anthus hodgsoni* *	i	gr	co, W	WI
234	Rosy Pipit *Anthus roseatus*	i	gr	ra, W	RK
235	Baya Weaver *Ploceus philippinus*	i	gr	co, R	WI
236	Indian Silverbill *Lonchura malabarica*	g	gr	ra, R	RK, C, T
237	White-rumped Munia *Lonchura striata* *	g	gr	uc, R	WI
238	Scaly-breasted Munia *Lonchura punctulata*	g	gr	co, R	RK, C, T
239	Black-headed Munia *Lonchura malacca*	g	gr	ra, R	RK, C, T

* Primarily forest species.

Ψ Mainly trespassing species.

USAID's Integrated Protected Area Co-Management (IPAC) Project
House 68 (2nd Floor) Road 1, Block I
Banani, Dhaka-1213, Bangladesh
Tel: +88-02-987-3229
Fax: +88-02-989-6164
Website: www.nishorgo.org