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Resident Forest Bird Populations and Co-Management Impacts

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Climate-Resilient Ecosystems and Livelihoods (CREL)
in association with Bangladesh bird club
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Cover photo: Green-billed Malkoha (Sayam U. Chowdhury),
above photo: Survey team (Sayam U. Chowdhury)

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EXECUTIVE SUMMARY

Assessing changes in forest condition is a challenge. Detailed forest inventories are time consuming and expensive, and while they can characterize and quantify forest structure, may not measure changes in wildlife due to additional factors such as hunting, or changes in plant and tree composition. Since 2005, soon after co-management was piloted in Bangladesh from 2003 onwards, a set of resident "indicator" forest birds representative of three forest habitat strata (ground/undergrowth, mid-level and canopy) have been monitored by experienced birdwatchers through support of Nishorgo Support Project, Integrated Protected Areas Co-Management Project and Climate Resilient Ecosystems and Livelihoods Project. The number of protected areas monitored has increased in line with the expansion of co-management, from five, to ten, to 15 sites in successive projects. Some indicator species were added to the initial eight, making 16 in total, with 10 or 11 per site based on experience of the species typical of different forest types and regions.

Methods have remained the same –the same defined transects (trails) in each site (2-6 and totaling 2.6 to 7.2 km depending on the site) were walked slowly (by an experienced bird watcher assisted by one or more local trained persons) once per month for 4-5 months during the breeding season (March to August) in each year. All individuals of the indicator species found within a strip 20-25 m (depending on the site) either side of the transect line were counted. This was repeated in each survey year, however in some years no surveys were undertaken, survey months in 2014 and 2015 were later than in most other years, and the surveyors differed between early and later years. Population density (individuals per km^2) for each species-site-year combination was calculated as the mean number of individuals of a species recorded on each transect (mean of different months), summed across all transects in that PA and divided by the total area of those transects. In addition, other bird species seen during transect surveys were noted contributing to total species lists for each protected area.

The data provide baseline estimates of indicator bird population densities for all 15 protected areas just after the formal start of co-management in each site. For five sites (Lawachara NP, Satchari NP, Rema-Kalenga WS, Chunati WS and Teknaf WS) data is available from 2005 to 2018, and for five sites (Medakacchapia NP, Fashiakhali WS, Kaptai NP, Madhupur NP and Khadimnagar NP) data is available from 2009 to 2018. Medium term trends are estimated for these ten sites as the annual percentage change comparing the mean of the first two years of data with the mean of the last two years of data, thereby standardizing for the different numbers of years surveyed. For 14 sites recent trends during CREL are also calculated as the annual percentage change comparing 2018 data with the mean of 2014 and 2015.

In 2018, Satchari NP had notably high densities of almost all indicator species surveyed with Rema-Kalenga WS also having high densities of four indicator species. Hence overall Satchari NP held high densities of the indicator species representing all three forest strata and indicting that this small site held some of the healthiest bird populations and by implication the most intact forest, with Rema-Kalenga also having good populations of birds across strata and therefore good quality forest. Khadimnager NP had high densities of undergrowth species, while Lawachara NP (also in the northeast) and Hazarikhil WS in Chittagong region had relatively high densities of canopy species. At the other extreme, Himchari NP, Medakacchapia NP and Teknaf WS were each missing five or six of the indicator species and in general have very low population densities for those species recorded, including undergrowth, mid-level and canopy species. This suggests that these sites have some of the poorest quality forest among these PAs. This reflects modest undergrowth, a lack of regenerating mid-level trees, and a lack of canopy trees (or in the case of Medakacchapia a single species canopy of Garjan *Dipterocarpus turbinatus* presumably lacking in diversity that would support a healthy avifauna).

Considering sites that have been monitored for nine or 13 years, in slightly more cases indicator species are declining than they are increasing. The situation in Medakacchapia NP is of great concern as seven species (including undergrowth, mid-level and canopy species) decreased greatly (by more

than 67% over a nine year period) and no indicator species increased. Also of great concern is Teknaf WS where four species (of mid-level and canopy) decreased greatly, and only one species increased slightly. At the opposite extreme Khadimnagar NP had five species recording rapid rates of increase, and only two species declining substantially, indicating that forest is recovering there. There are also positive signs for Rema-Kalenga WS and Modhupur NP where in both sites three species have increased substantially.

Trends in indicator species were averaged for each of the three forest strata. In four sites (Modhupur NP, Satchari NP, Rema-Kalenga WS and Khadimnagar NP), all in the north-east or north-central regions, there were more positive than negative trends (and in two of these sites there were increases for all three forest strata) suggesting that protection under co-management is having positive impacts. However, indicator birds of all three strata on average declined in Medhakachapia NP and Teknaf WS which are the two PAs where forest condition has clearly been worsening, here protection measures and forest restoration measures urgently need to be reviewed and strengthened by the stakeholders in co-management. There were fewer or less consistent trends in the other sites, with a mix of positive signs and also areas for concern. Considering the period of CREL support for co-management, in five of the 14 sites indicator species on average increased in all three forest strata since 2014 (Dudpukuria-Dhopachari WS, Hazarikhil WS, Fashiakhali WS, Lawachara NP and Rema-Kalenga WS) suggesting both recovery of understory and effective protection of taller trees during this period. Four sites (Chunati WS, Kaptai NP, Inani reserve forest, and Teknaf WS) showed similar short-term trends of loss of canopy species while undergrowth and mid-level species increased, indicating degradation of overall forest structure but regrowth of shrub layers. Trends were worse in Himchari NP where both mid-level and canopy indicator species declined. Lastly two sites reveal major imbalances in forest condition. In Medakacchapia NP mid-level species have been lost – forest here comprises a canopy of Garjan trees and recovering undergrowth. In Modhupur NP canopy species have been lost - large trees had all been felled earlier and the forest appears limited to undergrowth and secondary growth.

In addition to counting indicator species, all bird species were recorded during the surveys. The highest numbers of forest dependent species were found in the hilltracts in Dudhpukuria-Dhopachari NP and Kaptai NP; but diversity was also high in three sites in the northeast (Lawachara NP, Rema-Kalenga WS and Satchari NP), and in Hazarikhil WS in Chittagong region.

In general there are positive trends in forest bird populations, particularly for undergrowth species suggesting forest recovery in most sites. The following recommendations are made:

1. Urgently review and strengthen the protection and forest restoration measures by the stakeholders in co-management in Medakacchapia NP, Teknaf WS and Himchari NP where bird population densities are low and declining, which indicates declining forest health.

2. Identify those trees, notably fruiting species, and undergrowth species that forest dependent birds make most use of and use these in forest restoration in the most degraded areas, and to enrich those parts of protected areas with few native trees (such as plantations).

3. Continue annual monitoring of indicator birds by involving a mixture of local trained and interested persons (such as eco-guides and field level Forest Department staff) working with more experienced bird watchers using the same methods and four visits to each transects during March to June each year.

4. Add primate monitoring as part of the same transect based surveys in some sites.

5. Provide support to process data and share findings back each year to the concerned Co-Management Committees and Forest Department officials.

ACKNOWLEDGEMENTS

All of the survey team members from Bangladesh bird club over four years are listed in the table below, and without their efforts often in difficult monsoon conditions there would be no findings or report. In addition we are grateful for the assistance of the many local monitors who actively took part in the surveys, they are detailed in Annex 1. We also thank the concerned officials of the Bangladesh Forest Department for their generous assistance in helping access the forests and transect locations, and for permitting this survey, and the CREL project team particularly Ruhul Mohaiman Chowdhury and the regional coordinators and monitoring officers.

Bangladesh bird club survey team members for forest bird monitoring program 2014-2018.

No.	Name	2014	2015	2016	2018
1.	Bashir Ahmed	X			
2.	Bisharga Das	X			
3.	Enam Ul Haque	X	X	X	X
4.	Faisal Ahmed Peash	X			
5.	Hassan AR Chayan	X			
6.	Israt Jahan	X			
7.	Md. Foysal	X	X	X	X
8.	Mohsnin Kabir Miron	X	X	X	X
9.	Muntasir Akash				X
10.	Nazim Uddin Prince		X	X	X
11.	Niaz Abdur Rahman	X			
12.	Omar Shahadat	X	X	X	X
13.	Onu Tareq		X	X	
14.	Quazi Ahmed Hossain	X			
15.	Sajib Biswas				X
16.	Salauddin Zadid				X
17.	Samiul Mohsanin	X	X	X	X
18.	Sayam U. Chowdhury	X		X	X
19.	Shafiqur Rahman	X	X	X	
20.	Shuvo Shaha			X	
21.	Shibli Sadik		X	X	X
22.	Syed Shahnoor Inam				X
23.	Tania Khan	X	X	X	X
24.	Zohora Mila	X		X	

ABBREVIATIONS

Bbc	Bangladesh bird club
CREL	Climate Resilient Ecosystems and Livelihoods project
IPAC	Integrated Protected Areas Co-management project
NP	National Park
NSP	Nishorgo Support Project
PA	Protected Area
WS	Wildlife Sanctuary

CHAPTER 1 BACKGROUND

1.1 Introduction

USAID's Climate Resilient Ecosystems and Livelihoods (CREL) project works to promote collaborative management of natural resources in 31 bio-diverse sites including forest protected areas, wetlands and ecologically critical areas of Bangladesh. In this connection a significant aim of the project is to develop a robust baseline of biophysical status and trends in these areas. This report focuses on forest protected areas.

Co-management was first introduced in forest protected areas (PAs) in Bangladesh during 2003-04 in five forest PA sites - Lawachara National Park (NP), Satchari NP, Rema-Kalenga Wildlife Sanctuary (WS), Chunati WS and Teknaf WS - under the Nishorgo Support Project (NSP) with financial support from USAID. Later this approach was scaled up to another 13 forest PAs through the Integrated Protected Area Co-management (IPAC) Project of GOB-USAID, and to five more forest PAs in CREL Project.

Forest birds are considered here as a proxy indicator to measure bio-physical change in forest eco-systems since birds are more visible and responsive to ecological changes in their habitats than other species groups (Johnston 1956, Morrison 1986, Temple and Wiens 1989, Canterbury *et al.* 2000, Browder 2002).

The pilot phase of the indicator bird survey was conducted in the initial five co-managed PAs (Lawachara NP, Satchari NP, Rema-Kalenga WS, Chunati WS and Teknaf WS) during February-August of 2005-2008 and 2012 by Dr. M. Monirul H. Khan, Jahangirnagar University, his students and local community members also took part in these surveys. The results of these survey showed an increase of two birds (Red Junglefowl and Puff-throated Babbler), however the population densities of other species remained more or less unchanged.

Later in IPAC project five forest PAs (Kaptai NP, Fashiakhali WS, Medakacchapia NP, Modhupur NP and Khadimnagar NP) were included in bird surveys along with the original five PAs. Surveys covered 2009, 2010 and 2012, again conducted by Dr M. Monirul H. Khan supported by his students. Almost constant results were found, except that the density of Red Junglefowl showed a slight increase (IPAC 2012). To test how bird monitoring could be made more sustainable and incorporate it into co-management organization (CMO) monitoring tools, IPAC took an initiative with Bangladesh bird club (Bbc) to undertake surveys in 2011 through volunteers from the bird club and to train interested local people (CMO members) using the same methods, applying this to the same PAs and transects as those covered in 2009 and 2010.

As a continuation and expansion of the past surveys, CREL project contracted Bbc to conduct surveys of selected indicator resident forest birds in 14 PAs during April-July 2014 (the ten PAs previously surveyed plus four others - Inani Reserved Forest, Himchari NP, Dudpukuria-Dhopachari WS, and Hazarikhil WS), and to survey 15 PAs (adding Baroiyardhala NP) during March-July 2015, March-July 2016, and March-June 2018.

Resident bird surveys provide a proxy indicator to measure any biophysical changes as a result of better natural resource management through collaborative management. This report documents the CREL-Bbc collaboration. For ten PAs it compares the results from these surveys (2014, 2015, 2016, 2018) with earlier resident forest bird surveys in the same PAs to investigate trends, and for 14 PAs it compares trends within the four CREL supported surveys.

1.2 Conceptual Framework

Monitoring ecosystem health is a priority to determine the effectiveness of the shift to a co-management approach in forest PA sites in Bangladesh. Rigorous and scientifically valid indicators of changes in forest health are a challenge, but as noted earlier monitoring of populations of selected birds offers one measure of changes in forest condition. All of the surveys used strip transect sampling for indicator species, complemented by opportunistic recording of other species (see Chapter 2 for methods).

In addition, co-management itself and recent interest in preparing for "Reducing Emissions from Deforestation and Forest Degradation in Developing Countries" funding mechanisms both emphasize the need for community based monitoring as a sustainable tool for PA management and for Monitoring Reporting and Verification, and resident forest birds could be an indicator of use in tracking forest restoration and protection.

1.3 Capacity Building of Local Surveyors

While the co-management organizations are progressing with their institutional and managerial capacity building for conservation of unique natural resources in their protected areas, they are also expected to take initiative in monitoring the trends of resources and uses, and to make use of monitoring results. Hence the monitoring reported here also tried to develop greater community involvement in monitoring of indicator forest bird density.

During 2014-2018 a total of 69 local surveyors (selected by CREL) were trained by Bbc experts with orientation, hands-on orientation and resource materials, so that they could identify the indicator species as well as other common forest birds by sight and sound. They were introduced to the survey method, and then assisted in conducting the surveys. Booklets on the indicator birds were also provided. The local surveyors included 17 Forest Department staff (at each site Forest Department personnel were invited to participate through local CREL staff, although in four sites none actively participated). Also included are 13 Community Patrol Group members/leaders and 24 eco-guides (from all but two of the 15 sites) who enhanced their bird identification skills through participation in the monitoring. The performances of these individuals were assessed based on the following criteria: 1. Leadership; 2. Skill (bird identification); 3. Interest (birds, bird survey and wildlife in general); 4. Punctuality and 5. Communication. Annex 1 provides details of these local monitors, the years during which they assisted in the surveys, and their capacities for conducting further surveys.

CHAPTER 2 METHODS

2.1 Species and Sites Monitored

Based on the nature of forests (e.g. tropical mixed evergreen or deciduous) resident bird species dependent on different forest strata and relatively easy to detect and identify by call/song as well as visually were selected, initially under NSP with about eight species per site and later expanded to 10-11 species for each PA site (Tables 2.1 and 2.2). Some species from among the 16 do not naturally occur in a given PA and hence there are differences between sites in the species monitored from among the set of indicators (for example, White-crested Laughingthrush only occurs in southeast Bangladesh evergreen forests). These same species have been monitored along the same transects in each PA during roughly four months within March-August in each year (intended to cover the main breeding season, but in some years for various reasons with a late start in May or June).

Table 2.1 List of indicator forest (resident) birds.

SL	Indicator Birds	Scientific name	Resident in forest strata
1	Oriental Pied Hornbill	*Anthracoceros albirostris*	Upper
2	Hill Myna	*Gracula religiosa*	Upper
3	Scarlet Minivet	*Pericrocotus flammeus*	Upper
4	Black-crested Bulbul	*Pycnonotus melanicterus*	Upper
5	Green-billed Malkoha	*Phaenicophaeus tristis*	Middle
6	Red-headed Trogon	*Harpactes erythrocephalus*	Middle
7	Greater Racquet-tailed Drongo	*Dicrurus paradiseus*	Middle
8	Hair-crested Drongo	*Dicrurus hottentottus*	Middle
9	White-rumped Shama	*Copsychus malabaricus*	Middle
10	Crimson Sunbird	*Aethopyga siparaja*	Middle
11	Red Junglefowl	*Gallus gallus*	Lower
12	Puff-throated Babbler	*Pellorneum ruficeps*	Lower
13	Abbott's Babbler	*Malacocincla abbotti*	Lower
14	White-crested Laughingthrush	*Garrulax leucolophus*	Lower
15	Orange-headed Thrush	*Zoothera citrina*	Lower
16	Crested Serpent Eagle	*Spilornis cheela*	Mixture of strata

Fig. 2.1a Indicator species - canopy


Oriental Pied Hornbill

Common Hill Myna


Scarlet Minivet (left female, right male)

Black-crested Bulbul

Fig 2.1b Mid-level indicator species


Green-billed Malkoha

Greater Racquet-tailed Drongo



Red-headed Trogon (left male, right female)

Hair-crested Drongo

Fig 2.1b Mid-level indicator species (continued)

White-rumped Shama (left female, right male) Crested Serpent Eagle

Crimson Sunbird (left male, right female) Crested Serpent Eagle

Fig. 2.1c Ground and understory indicator species

Red Junglefowl (left female, right male) Orange-headed Thrush

Abbott's Babbler Puff-throated Babbler White-crested Laughingthrush

Photos: Sayam U Chowdhury, Paul Thompson, Enam Ul Haque, Samiul Mohsanin, and CM Reza

Table 2.2 Indicator species and Protected Areas where they were surveyed

Sl	English Name	*Scientific Name*	Strata	Main Food	Chunati WS	Kaptai NP	Dudpuk-uria WS	Hazari-khil WS	Baroiya dhala NP	Fashia-khali WS	Medaka-cchapia NP	Him-chari NP	Inani RF	Teknaf WS	Lawa-chara NP	Sat-chari NP	Rema-Kalenga WS	Khadim-nagar NP	Madhu-pur NP
1	**Red Junglefowl**	*Gallus gallus*	G	Seeds	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
2	**Puff-throated Babbler**	*Pellorneum ruficeps*	G	Insects	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
3	**Abbott's Babbler**	*Malacocincla abbotti*	L	Insects		Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	
4	**White-crested Laughingthrush**	*Garrulax leucolophus*	L	Insects	Y									Y					
5	**Orange-headed Thrush**	*Zoothera citrina*	L	Insects															Y
7	**Red-headed Trogon**	*Harpactes erythrocephalus*	M	Insects	Y		Y	Y	Y			Y	Y	Y	Y	Y	Y		
8	**Green-billed Malkoha**	*Phaenicophaeus tristis*	M	Insects	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
9	**Greater Racquet-tailed Drongo**	*Dicrurus paradiseus*	M	Insects	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
10	**Hair-crested Drongo**	*Dicrurus hottentottus*	M	Insects															Y
6	**White-rumped Shama**	*Copsychus malabaricus*	M	Insects	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
11	**Crimson Sunbird**	*Aethopyga siparaja*	M	Nectar		Y	Y	Y		Y	Y	Y	Y					Y	Y
12	**Oriental Pied Hornbill**	*Anthracoceros albirostris*	U	Fruits	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
13	**Scarlet Minivet**	*Pericrocotus flammeus*	U	Insects	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
14	**Black-crested Bulbul**	*Pycnonotus melanicterus*	U	Fruits															Y
15	**Hill Myna**	*Gracula religiosa*	U	Fruits	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
16	**Crested Serpent Eagle**	*Spilornis cheela*	M	Snakes		Y				Y	Y							Y	Y
	Total species				10	11	11	11	10	11	11	11	11	10	10	10	10	11	10

Grey indicates species not monitored during NSP or IPAC in a site where monitoring started prior to CREL.
G – ground, L – lower strata, M – mid strata, U – upper canopy; for analysis purposes ground and lower strata were combined into one category

2.2 Transect Method

The strip transect sampling method was applied at 15 PAs to conduct this survey. In this method objects (birds) are counted along more-or-less straight, long and narrow strips. This is suitable for population estimation of visible and mobile organisms. In this method some permanent strips are selected where the total counts of the objects are made. The observer(s) slowly moved (ca. 1.5 km/hour) along a relatively straight line (basal line) through the study area and counted the objects (individual birds of each indicator species) from both sides of the transect trail. The observation-range (half-width of the strip) can be selected depending on visibility/detectability in the study area, and in the surveys reported here fixed widths were determined (rather than variable-width methods). For these forest sites an observation-range of 25 m on either side was found suitable, so the width of transect was 50 m. However, this was treated as 20 m on each side with a total width of 40 m in the case of five sites where monitoring started under NSP for consistence with the earlier surveys in those sites. The years covered and number of transects are shown in Table 2.3.

Table 2.3 Years and numbers of transects surveyed by Protected Area for resident forest bird monitoring.

No.	Region	Protected Areas	Project started	Years surveyed	No. of transects	Length (km)
1	Ctg	Chunati WS	NSP	2005-2008, 2012, 2014, 2015, 2016, 2018	5	5.32 (3.47)[a]
2	Ctg	Kaptai NP	IPAC	2009, 2010, 2012, 2014, 2015, 2016, 2018	4 (5)[b]	5.59 (7.20)[b]
3	Ctg	Dudpukuria-Dhopachari WS	CREL	2014, 2015, 2016, 2018	4	6.10
4	Ctg	Hazarikhil WS	CREL	2014, 2015, 2016, 2018	4 (3)[c]	4.50 (4.00)[c]
5	Ctg	Baroiyadhala NP	CREL	2015, 2016, 2018	3	6.13
6	Cox B	Fashiakhali WS	IPAC	2009, 2010, 2012, 2014, 2015, 2016, 2018	2	2.65
7	Cox B	Medakacchapia NP	IPAC	2009, 2010, 2012, 2014, 2015, 2016, 2018	2	2.60
8	Cox B	Himchari NP	CREL	2014, 2015, 2016, 2018	2	4.00
9	Cox B	Inani RF	CREL	2014, 2015, 2016, 2018	2	3.50
10	Cox B	Teknaf WS	NSP	2005-2008, 2012, 2014, 2015, 2016, 2018	5	6.96
11	Sylhet	Lawachara NP	NSP	2005-2008, 2012, 2014, 2015, 2016, 2018	6	3.72
12	Sylhet	Satchari NP	NSP	2005-2008, 2012, 2014, 2015, 2016, 2018	3	3.00
13	Sylhet	Rema-Kalenga WS	NSP	2005-2008, 2012, 2014, 2015, 2016, 2018	4	4.69
14	Sylhet	Khadimnagar NP	IPAC	2009, 2010, 2012, 2014, 2015, 2016, 2018	3	4.51
15	Central	Madhupur NP	IPAC	2009, 2010, 2012, 2014, 2015, 2016, 2018	4	5.80

[a] Transect length reduced in 2018 due to access issues
[b] One transect was dropped from 2012 onwards as it was located on the opposite side of a branch of the lake
[c] One transect dropped in 2016 and 2018

The initial location of the object (bird) was considered while counting, because the object (bird) often moves away after seeing the observer(s). If any object was sighted beyond the pre-determined observation-range (strip width), or if the object was seen coming from the back (in order to avoid duplication), the object was not counted, the concept of the method is shown in Fig. 2.1. For birds documented on call/song, their distance from the transect line was estimated from experience by the observer and an object was recorded if it was within the defined transect width (this aspect of method was not specifically documented in reports under NSP and IPAC). A standard data sheet was used to record the counts of indicator birds (Annex 2).

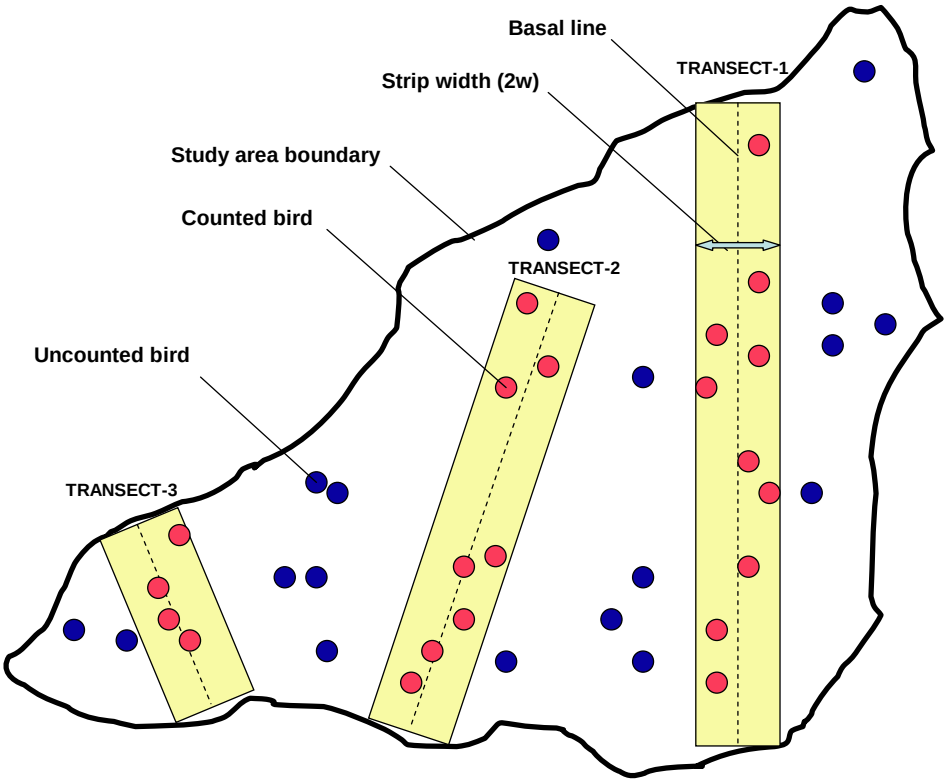

Fig. 2.1 Diagrammatic representation of strip transect sampling to estimate bird population density in a study area (source: IPAC, 2012).

In each year each transect was walked and indicator birds counted on 3-5 occasions, but not more than once in any given month. Density was calculated as the mean number of individuals of a species recorded on each transect (mean of different months), summed across all transects in that PA and divided by the total area of those transects (length x 50 m or 40 m according to the site).

2.3 Opportunistic Data and Species Diversity

In addition to the main survey, opportunistic methods were used for recording all species encountered during transect surveys (but individuals were not counted) which provides additional information on diversity and species composition. All species recorded by year are shown in Annex 3.

2.4 Details of Trails used as Transects

Two broad habitat types were taken into consideration while transects were selected, and the aim was to represent both of these habitats roughly to the extent that they exist in each PA:

1. Mature Forest: moderately dense natural forest mixed with evergreen trees, streams with undergrowth and riparian growth.
2. Degraded Forest: degraded forest with few trees, plantations, orchards, moderate undergrowth etc.

To ensure consistency in methods in any future repeat surveys, details including coordinates and maps of each transect in each PA surveyed are given in Tables 2.4 to 2.6, arranged by batches according to the project that first started indicator bird monitoring.

Table 2.4: Strip transects in five PAs where bird monitoring was started under NSP (same transects continue to be used).

Name of Project Site	Name of Transect	Location in Project Site	GPS coordinates 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	Gas field, Stream	0.50
	Train Line	Central	24°19.7¢ N, 91°47.2¢ E; 24°19.8¢ N, 91°47.5¢ E	Signboard, Metaled 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
	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
	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
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, Metaled 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	21°55.3¢ N, 92°02.7¢ E; 21°55.5¢ N, 92°02.3¢ E	Second tower, Banyan tree	0.76
	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	Metaled 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	0.70
	Brickfield*	Eastern	21°55.7¢ N, 92°02.5¢ E; 21°56.1¢ N, 92°03.5¢ E	Fishery, Paddyfield	1.91
	Banopukur South	Northern	21°57.2¢ N, 92°03.7¢ E; 21°57.4¢ N, 92°04.0¢ E	Western 'garjan', Farm	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°05.8¢ N, 92°09.8¢ E; 21°05.2¢ N, 92°10.2¢ E	Kudum cave, Mahogany plantation	1.27
	Shukna Amtoli	Northern	21°05.2¢ N, 92°10.2¢ E; 21°05.4¢ N, 92°09.5¢ E	Dead banyan tree, 'Jhum' cultivation	0.75
	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

* not accessible in 2018

Table 2.5: Strip transects at five PAs where bird monitoring was started under IPAC (same transects continued to be used).

Name of Project Site	Name of Transect	GPS coordinates of two ends	Landmarks at Two Ends	Length (km)
Kaptai National Park	Rampahar Stream	22°29.709′ N, 92°11.123′ E; 22°30.469′ N, 92°10.440′ E	Balurchar, Intersection	1.80
	Rampahar Hill	22°30.469′ N, 92°10.440′ E; 22°29.880′ N, 92°10.583′ E	Intersection, Culvert	1.10
	Jamaichara*	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	22°30.663′ N, 92°12.451′ E; 22°30.937′ N, 92°12.182′ E	Milestone, Forest end	0.69
	Bangchari	22°30.040′ N, 92°11.697′ E; 22°31.576′ N, 92°11.138′ E	Main road, Debachari	3.00
Fashiakhali Wildlife Sanctuary	Lama Road	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	21°42.338′ N, 92°04.765′ E; 21°42.369′ N, 92°05.315′ E	Natunpahar mosque, Garzanbunia	0.95
Medakacchapia National Park	Meda-Kacchapia East	21°38.484′ N, 92°04.402′ E; 21°38.329′ N, 92°05.080′ E	Cox's Bazar road, Kurahari	1.20
	Meda-Kacchapia 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	24°57.248′ N, 91°56.311′ E; 24°56.673′ N, 91°55.689′ E	Khadimnagar office, Kalagool	1.50
	Khadimnagar Central	24°56.677′ N, 91°56.391′ E; 24°57.248′ N, 91°56.311′ E	South border, Khadimnagar office	1.10
	Choragang Road	24°57.248′ N, 91°56.311′ E; 24°56.975′ N, 91°57.198′ E	Hindur Jhiri, Brickfield	1.91
Madhupur National Park	Rasulpur	24°41.342′ N, 90°08.350′ E; 24°41.488′ N, 90°07.015′ E	Rasulpur office, Koia Pukur	2.30
	Jalui	24°41.342′ N, 90°08.350′ E; 24°40.779′ N, 90°07.683′ E	Rasulpur office, Jalui office	1.50
	Lahoria	24°41.730′ N, 90°06.283′ E; 24°41.631′ N, 90°05.760′ E	Lahoria office, west intersection	0.90
	Monar Bide	24°40.211′ N, 90°06.287′ E; 24°40.811′ N, 90°06.137′ E	Metaled road, Gaira	1.10

* not surveyed since 2012 as inaccessible during wet season since it is on opposite side of lake

Table 2.6. Strip transects at five PAs where bird monitoring was started under CREL

Name of the PA	Transect Name	GPS coordinates of two ends	Landmarks at Two Ends	Length (km)
Inani RF	Shilbuniar Chara	N 21°13.599′ E 92°03.202′ N 21°13.316 E 92°03.507′	Shilbuniar Chara Gonamrmore, Lui Kum	2.00
	Boro Khal	N 21°13.300′ E 92°03.509′ N 21°13.385 E 92°03.108′	Lui Kum, Patakata	1.50
Himchari NP	Sagar Nibash	N 21°21.509′ E 92°01.145′ N 21°21.451 E 92°02.244′	Hill slope, Banyan tree	1.50
	Barachara	N 21°22.000′ E 92°02.100′ N 21°23.455 E 92°02.023′	Chainda slope, Barachara culvert	2.50
Dudpukuria-Dhopachari WS	Chapachari (Dhopachari)	N 22°13.508′ E 92°06.536′ N 22°13.499 E 92°06.537′	Open field near pond, End of stream	1.90
	Nikhonchari (Dhopachari)	N 22°13.866′ E 92°06.810′ N 22°14.160′ E 92°06.507′	Mango tree, End of stream	1.10
	Forest Office (Dudpukuria)	N 22°18.634′ E 92°09.138′ N 22°18.179′ E 92°09.008′	Beat office, End of the hill,	1.70
	Guard Box (Dudpukuria)	N 22°18.796′ E 92°09.061′ N 22°19.017′ E 92°08.905′	Guard box, Large Gorjon tree	1.40
Hazarikhil WS	Tea Garden	N 22°42.255′ E 91°41.346′ N 22°42.599′ E 92°41.108′	Billerjer para, End of stream	1.10
	Butiakhola	N 22°42.616′ E 91°41.094′ N 22°42.178′ E 92°40.688′	Teak plantation, Hill top	1.70
	New Bridge	N 22°42.213′ E 91°42.184′	New bridge,	1.20

Name of the PA	Transect Name	GPS coordinates of two ends	Landmarks at Two Ends	Length (km)
		N 22º41.972´ E 92º40.839´	Wall of sedimentary rock	
	Shabhuddin*	N 22º42.384´ E 91º41.603´ N 22º42.341´ E 92º41.443´	Shabuddin's house, Forest Department rest house	0.50
Baroiyadhala National Park	Bauachara	N 22º42´43.0 E 91º37´34.9 N 22º43´23.7 E 91º37´32.5	Fisher lake, Hill stream	1.83
	Khaiyachara	N 22º46´20.0 E 91º36´15.6 N 22º46´09.0 E 91º37´32.5	Tea stall, Waterfall	1.90
	Modhukhaiya	N 22º40´36.0 E 91º38´33.7 N 22º41´12.6 E 91º39´18.6	Beat office, End of brick road.	2.40

* not surveyed in 2016 and 2018 because it was inaccessible due to rain.

Maps showing the routes of transects monitored in five PAs where resident bird monitoring was first introduced under CREL are shown in Figs. 2.1 to 2.7 below.

Fig. 2.1 Detailed map of Dudpukuria-Dhopachari WS (combined), the white lines represent the transects, yellow and blue mark represent the start and end points of each transect.

Fig. 2.2 Detailed map of Dudpukuria, the white lines represent the transect, yellow and blue mark represent the start and end points of each transect.

Fig. 2.3: Detailed map of Dhopachari, the white lines represent the transects, yellow and blue mark represent the start and end points of each transect.

Fig. 2.4: Detailed map of Hazarikhil WS, the white lines represent the transects, yellow and blue mark represent the start and end points of each transect.

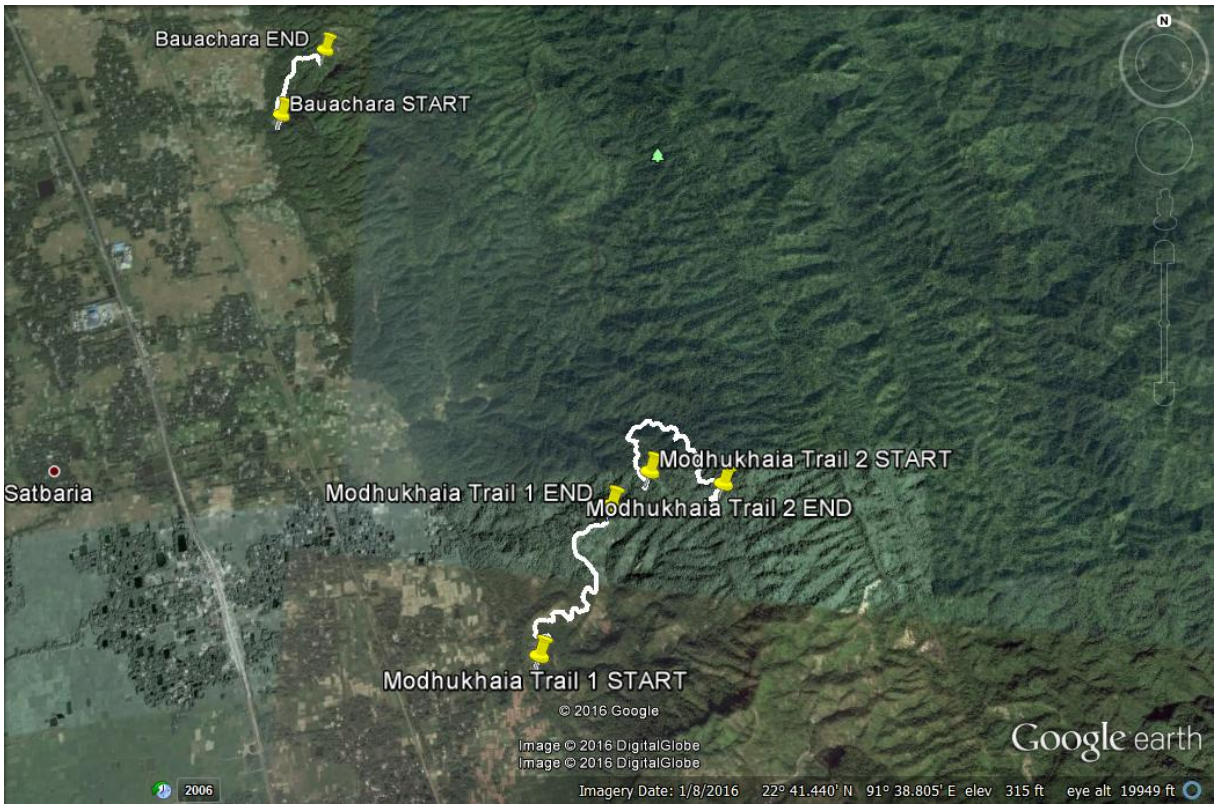

Fig. 2.5: Detailed map of Baroiyadhala, the white lines represent the transects, yellow and blue mark represent the start and end points of each transect.

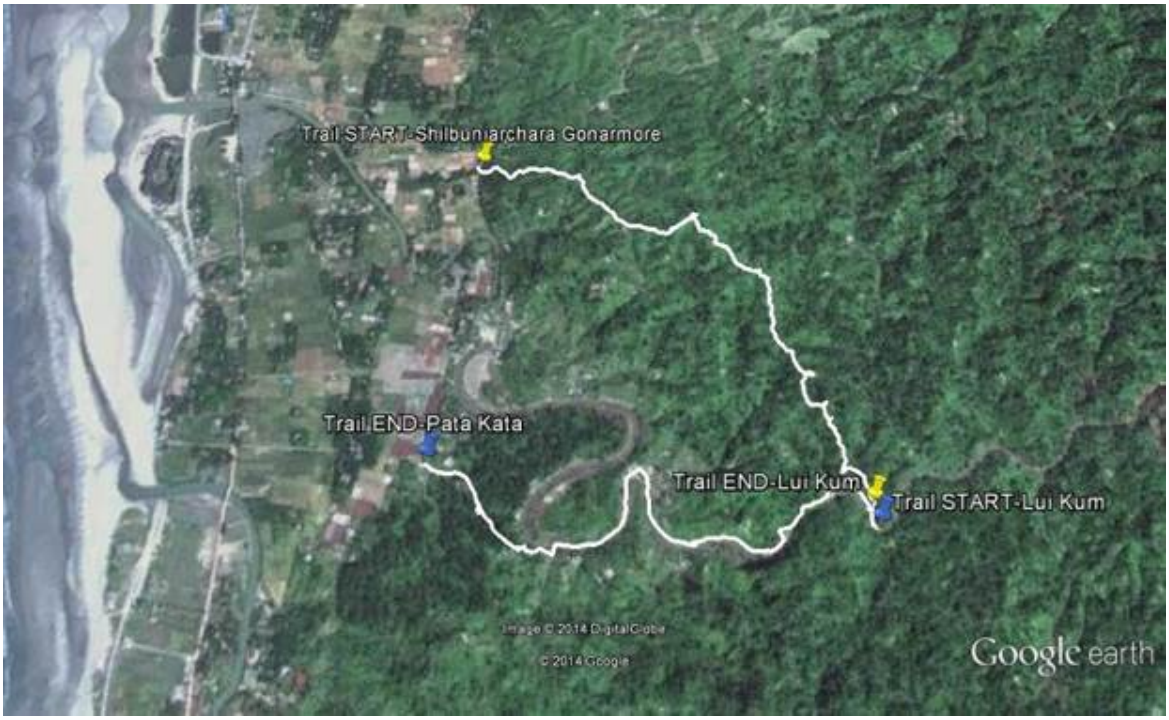

Fig. 2.6: Detailed map of Himchari, the white lines represent the transects, yellow and blue mark represent the start and end points of each transect.

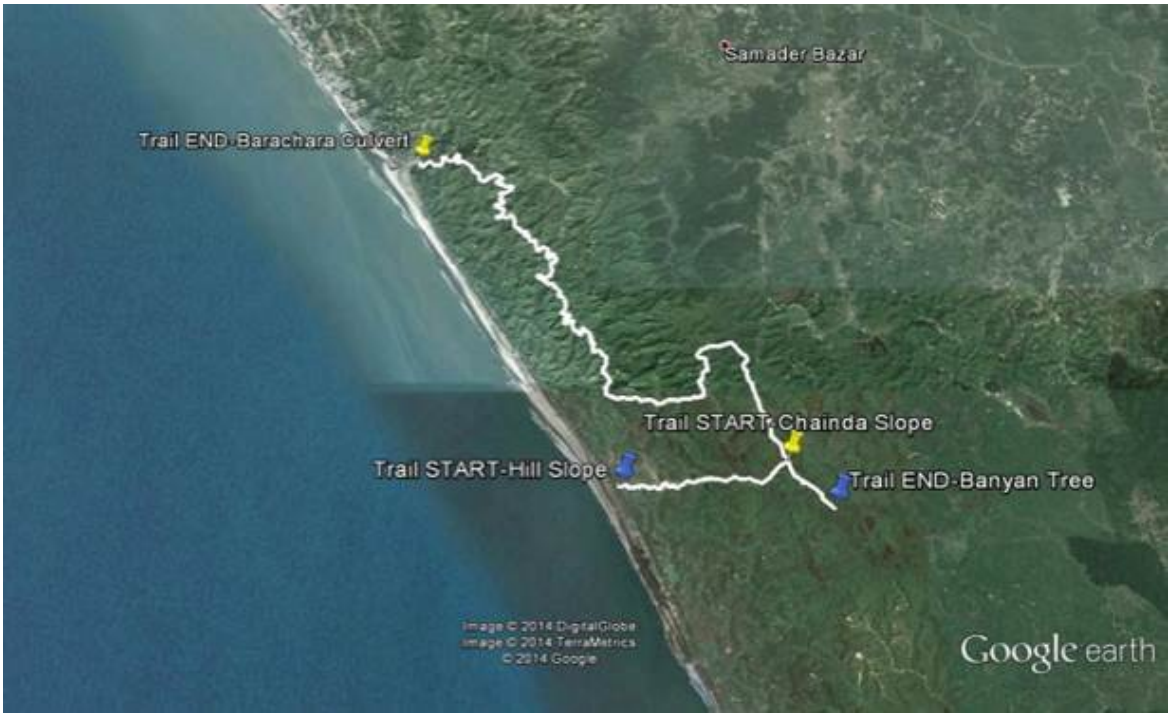

Fig. 2.7: Detailed map of Inani, the white lines represent the transects, yellow and blue mark represent the start and end points of each transect.

The habitats surveyed and some of the survey teams are shown in the following photographs, one for each of the 15 PAs.

Field survey, Chunati NP 2015

Field survey, Kaptai NP 2016

Field survey, Dudpukuria-Dhopachari WS 2016

Hazarikhil NP 2012

Field survey, Baroiyadhala NP 2015

Field survey, Fasiakhali WS 2015

Medhakacchapia NP 2016

Field survey, Himchari NP 2016

Field survey, Inani reserve forest 2015

Field survey, Teknaf WS 2018

Field survey, Lawachara NP 2015

Field survey, Satchari NP 2018

Field survey, Rema-Kalenga WS 2014

Field survey, Khadimnagar NP 2015

Field survey, Modhupur NP 2016

Photos: Bbc survey team members

CHAPTER 3 RESULTS AND DISCUSSION

3.1 General Achievements

From the opportunistic component of the surveys, a total of 192 species were recorded (including indicator species) in all 15 PAs during four years 2014, 2015, 2016, and 2018 comprising 169 residents, 15 winter visitors, three passage migrants, three breeding summer visitors, and two vagrants (Annex 3).

Although the same survey method, indicator birds (with some additions) and transacts were applied in 15 sites, some of the results show considerable differences between years. Possible reasons could be: changes in bird populations associated with habitat changes or other factors (although changes between the earlier years were relatively small); differences in bird identification and counting skills, differences in understanding of transects, and inconsistencies in actual survey and calculation method followed (but this is unlikely); or because the 2016 and 2018 surveys covered the main breeding season (March-June) whereas for example the 2014 and 2015 surveys covered a later period (May/June onwards), and surveys up to 2012 generally covered April-July.

For each monitored Protected Area, a comparison of indicator species density (birds/km^2) is presented in this chapter comparing all surveys (supported by CREL, by IPAC and by NSP). This covers the period 2005 through to 2018 for Lawachara NP, Satchari NP, Rema-Kalenga WS, Chunati WS and Teknaf WS; the period 2009 to 2018 for Medakacchapia NP, Fashiakhali WS, Kaptai NP, Madhupur NP and Khadimnagar NP; the period 2014 to 2018 for Dudpukuria-Dhopachari WS, Hazarikhil WS, Himchari NP and Inani Reserve Forest; and the years 2015, 2016 and 2018 for Baroyadhala NP.

3.2 Chittagong Region

3.2.1 Chunati Wildlife Sanctuary

Average indicator bird populations for all three strata (ground/undergrowth, mid-level and canopy) have declined overall since 2005 (Table 3.1), with the highest rate of loss of 7% per year for canopy species and almost no change for ground/undergrowth species. This is based on six indicator species that are regularly present in this PA and that were monitored since the first NSP survey (Table 3.2). By comparison over a four year period (2014 to 2018) average rates of change were greater and indicated continued loss of canopy species but increases in species using the mid-level and undergrowth. Trend estimates for a shorter period such as during CREL project are less reliable but indicate recovery of undergrowth and mid-level birds and their habitats that have been declining over a longer period. However, one indicator bird Oriental Pied Hornbill has never been recorded in the surveys and two - White-crested Laughingthrush and Hill Myna - were lost by the 2014 survey and were not recorded during any years with

Table 3.1 Average indicator bird population trends in Chunati WS (% change pa)

Strata	13 year	4 year
Undergrowth/ground	-0.51	74.20
Mid-level	-3.19	49.13
Canopy	-7.69	-25.00

Table 3.2 Trends in bird populations in Chunati WS

	% change pa*	
Species	**13 years**	**4 years**
Greater Racket-tailed Drongo	-5.71	100.00
White-crested Laughingthrush	-9.09	lost
Red Junglefowl	-4.57	145.43
Green-billed Malkoha	Ns	21.51
White-rumped Shama	-7.68	-25.00
Hill Myna	-9.09	lost
Puff-throated Babbler	-2.59	2.96
Scarlet Minivet	Ns	-25.00
Red-headed Trogon	Ns	100.00

* Percentage change in density standardized per year based on: 13 years = mean of 2016 and 2018 compared with mean of 2005 and 2006; 4 years = 2018 compared with mean of 2014 and 2015
Ns – not surveyed before CREL so not calculable
100.00 indicates species absent in 2014 and 2015 but recorded in 2018

CREL surveys although they were regular in the early years of surveys (Fig. 3.1).

An increase in Puff-throated Babbler, Red Junglefowl, Green-billed Malkoha, White-rumped Shama, Greater Racket-tailed Drongo, and the first records of Red-headed Trogon during the 2016 and 2018 surveys indicate that ground and middle stratum conditions may have improved over the last four years. These habitats support scrub, bush dwelling and insect eating birds, especially along the Two Tower trail where habitat restoration through mixed plantation is apparent. Absence and loss of top canopy species including Oriental Pied Hornbill, Scarlet Minivet, and Hill Myna (last record in 2012) is due to the visible lack of large and fruit bearing trees in the site, which will take decades to recover.

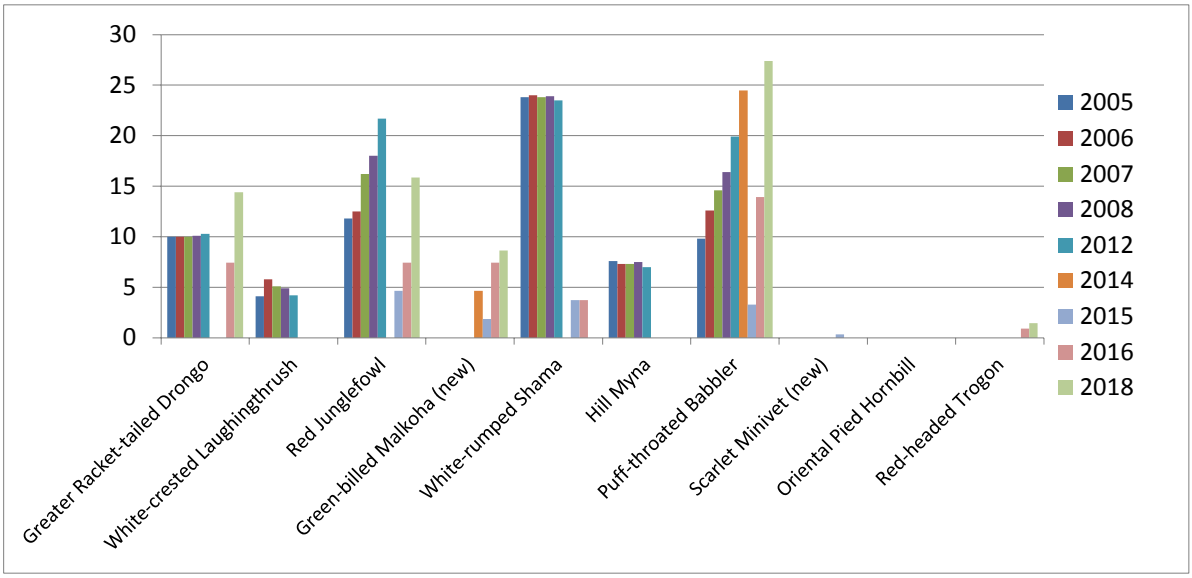

Fig. 3.1: Density of indicator birds (birds/km²) in Chunati Wildlife Sanctuary 2005 to 2018.

3.2.2 Kaptai National Park

Although co-management of this NP has ended and CREL support there was suspended after 2014, monitoring was continued in the interest of documenting trends in a "control" site. The density (or estimated population) of most of the indicator species has fluctuated between years since 2009 with no clear trend (Fig. 3.2). Overall numbers of most species were low in 2015, but recovered in 2016, then declined again in 2018 except for White-rumped Shama, Abbott's Babbler and Hill Myna which increased. Since 2009 average indicator bird populations for ground/undergrowth are unchanged, those for mid-level species have increased, and canopy indicator bird populations have declined (Table 3.3). This is based on 11 indicator species that are regularly present in this PA and that were monitored since 2009 (Table 3.4). By comparison over a four year period (2014 to 2018) undergrowth and mid-level species increased considerably despite co-management ending in this period, indicating recovery of undergrowth and mid-level birds and their habitats.

Table 3.3 Average indicator bird population trends in Kaptai NP(% change pa

Strata	9 year	4 year
Undergrowth/ground	0.54	11.50
Mid-level	6.49	15.05
Canopy	-1.29	-0.86

Table 3.4 Trends in bird populations in Kaptai NP

Species	% change pa*	
	9 years	4 years
Greater Racket-tailed Drongo	8.17	40.2
Crested Serpent Eagle	0.00	68.8
Red Junglefowl	1.79	18.4
Green-billed Malkoha	16.53	18.4
White-rumped Shama	2.32	15.5
Hill Mynah	2.06	-5.8
Puff-throated Babbler	1.79	0.2
Abbott's Babbler	-1.97	15.9
Scarlet Minivet	-9.26	0.1
Crimson Sunbird	-1.06	-14.0
Oriental Pied Hornbill	3.33	3.1

* Percentage change in density standardized per year based on: 9 years = mean of 2016 and 2018 compared with mean of 2009 and 2010; 4 years = 2018 compared with mean of 2014 and 2015

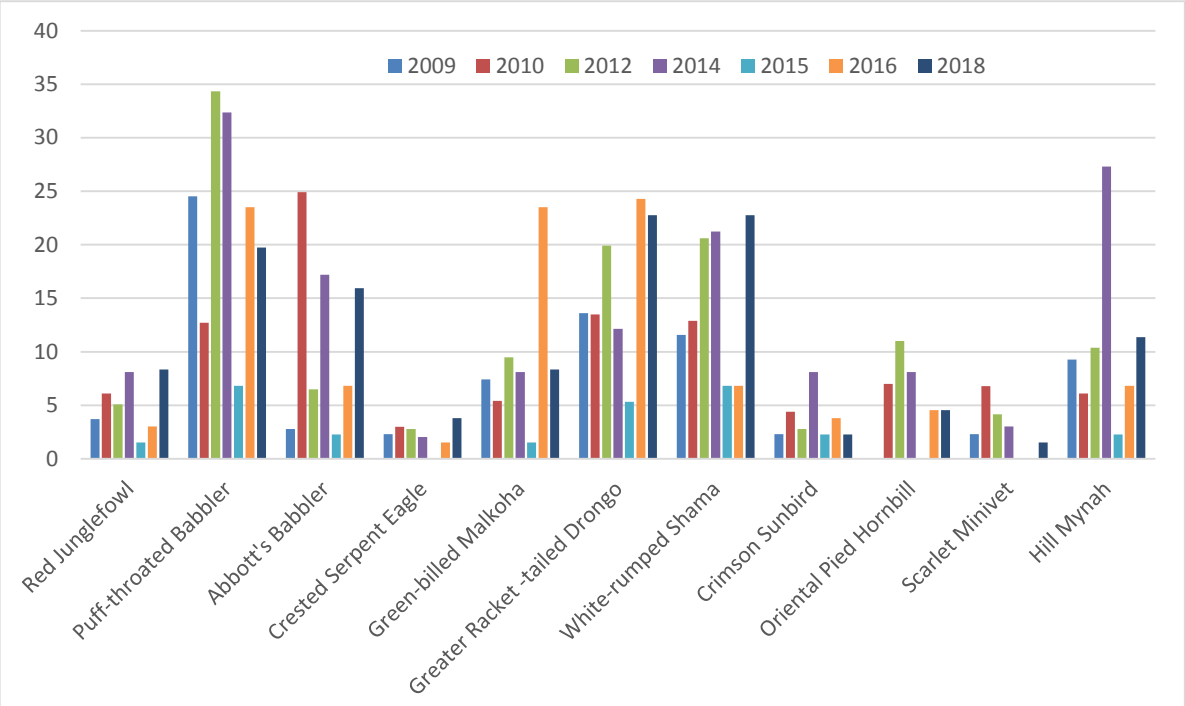

Fig. 3.2: Density of indicator birds (birds/km²) in Kaptai National Park 2009 to 2018.

The upper canopy species trend is unclear: Hill Myna showed a considerable increase in 2014 and then decreased to its lowest numbers in the next year (2015) and then increased again in 2016 and 2018 returning to more typical numbers, and overall appears to be increasing (Table 3.4). The population of Crested Serpent-eagle appears little changed. However, Scarlet Minivet clearly shows a decline over nine years, and was not recorded in 2015 or 2016. Oriental Pied Hornbill numbers are probably little changed – the increasing trend shown is affected by none being recorded in 2009, this species is dependent on large old trees for nesting hollows and the stable or slight increase indicates that large trees are being protected. Overall canopy species have been declining at about 1% a year, presumably reflecting some loss of large trees, or the legacy of past loss of large trees.

Among middle-lower canopy species Greater Racket-tailed Drongo and Green-billed Malkoha showed a sharp increase in 2016 but declined again in 2018. White-rumped Shama and Abbott's Babbler showed considerable increase in 2018, Crimson Sunbird appeared to be decreasing in 2018 after an improvement in 2016. Consolidating these trends, mid-level species appear to be increasing – a positive sign of healthy and presumably increasing numbers of smaller trees and regenerating trees.

The general trend for all three undergrowth and ground dwelling birds – Red Junglefowl, Puff-throated Babbler and Abbott's Babbler - has been for recent increases in population since 2014 (although estimated density has fluctuated and appeared to decline greatly in 2015 only to increase in 2016 and 2018). Overall there is little real trend for these species and the ending of co-management does not appear to have had adverse impacts since these species would be vulnerable to hunting and cutting of firewood.

3.2.3 Dudpukuria-Dhopachari Wildlife Sanctuary

Bird monitoring at Dudpukuria-Dhopachari WS started in 2014 when transects were established (two in Dudpukuria and two in Dhopachari) covering 6.1 km (length), so trends are not so reliable

Table 3.5 Average indicator bird population trends in Dudpukuria-Dhopachari WS (% change pa)

Strata	4 year
Undergrowth/ground	11.50
Mid-level	15.05
Canopy	-0.86

over just four years, but indicate increasing populations of undergrowth/ground and mid-level species (Table 3.5).

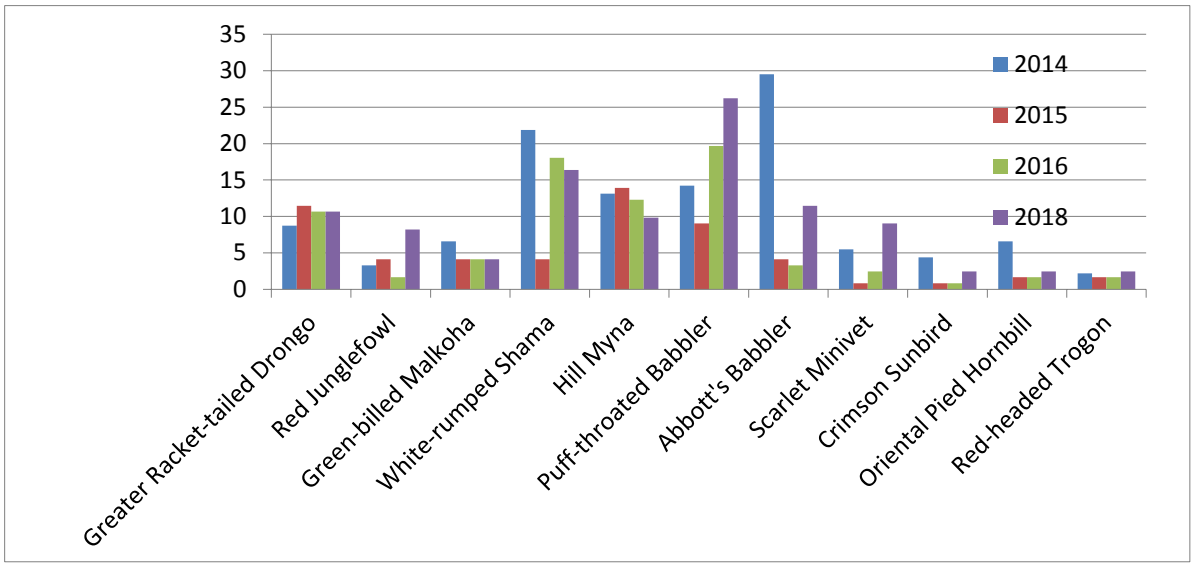

Fig. 3.3: Density of indicator birds (birds/km²) in Dudpukuria-Dhopachari Wildlife Sanctuary during 2014-2018.

All indicator bird species were recorded every year, and all species show an increasing trend in 2018 compared with 2016 except for White-rumped Shama and Hill Myna. (Fig. 3.3). Two ground and undergrowth species – Puff-throated Babbler and Red Junglefowl - show a strongly increasing trend, so the overall health of lower strata appears to be improving. A steady or slightly increasing density of Greater Racket-tailed Drongo, Scarlet Minivet, Red-headed Trogon and Crimson Sunbird indicates unchanged or improving middle forest strata, but the upper (canopy) strata may be deteriorating over these four years.

Table 3.6 Trends in bird populations in Dudpukuria-Dhopachari WS (% change pa)

Species	4 years*
Greater Racket-tailed Drongo	1.4
Red Junglefowl	30.6
Green-billed Malkoha	-5.8
White-rumped Shama	6.5
Hill Myna	-6.8
Puff-throated Babbler	31.5
Abbott's Babbler	-7.9
Scarlet Minivet	46.8
Crimson Sunbird	-1.3
Oriental Pied Hornbill	-10.0
Red-headed Trogon	7.1

* Percentage change in density standardized per year based on 4 years - 2018 compared with mean of 2014 and 2015

3.2.4 Hazarikhil Wildlife Sanctuary

Hazarikhil Wildlife Sanctuary is one of the sites where co-management is new, and forest bird monitoring was introduced along four transects (total 4.5 km long) in June 2014, and these were re-surveyed in 2015, 2016 and 2018. Continuous presence and increasing numbers of Red Junglefowl, Puff-throated Babbler and Abbott's Babbler in 2018 indicating healthy and improving scrubby, undergrowth and forest floor vegetation (Fig. 3.4). The densities of higher canopy species such as Scarlet Minivet and Oriental Pied Hornbill were higher in 2018 than previous years, although these densities cannot be regarded as a reliable trend, as more years of monitoring are needed they do indicate that major losses of mature trees did not occur. In addition, evidence of breeding Oriental Pied Hornbill was found in 2016.The mid-strata species including White-rumped Shama and Greater Racket-tailed Drongo were recorded regularly along all transects and most of their populations appear to be increasing. Overall, almost all indicator birds show increases since 2014, indicating good health of the forest and possibly reflects positive work by the newly active co-management committee.

Table 3.7 Average indicator bird population trends in Hazarikhil WS (% change pa)

Strata	4 years
Undergrowth/ground	50.90
Mid-level	23.38
Canopy	21.76

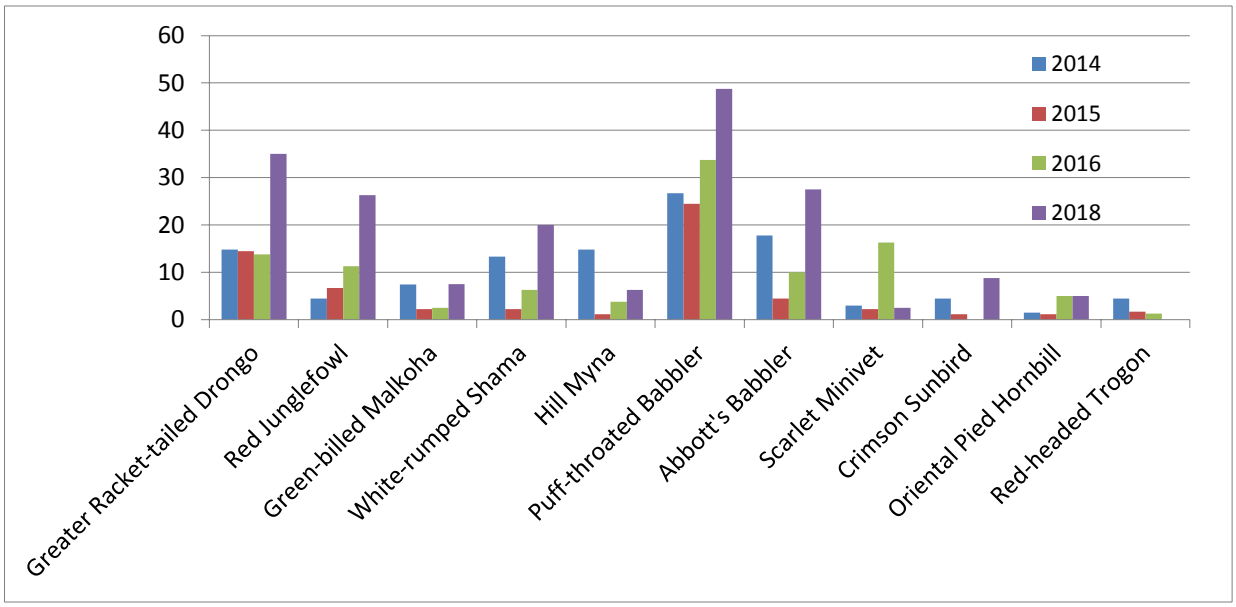

Fig. 3.4: Density of indicator birds (birds/km²) in Hazarikhil Wildlife Sanctuary during 2014, 2015 and 2016.

3.2.5 Baroiyadhala National Park

Co-management was newly established in Baroiyadhala National Park under CREL, and it was added to the forest bird monitoring scheme in 2015 when two transects were established covering 6.13 km. Seven out of ten indicator birds were recorded in 2015-2018. Although the survey period is the shortest of all the sites studied, the increasing trends of Red Junglefowl, Puff-throated Babbler, Abbott's Babbler, White-rumped Shama, and Green-billed Malkoha suggest that the condition of secondary vegetation with shrubby growth and middle level trees is improving (Fig 3.5). Absence of Oriental Pied Hornbill and Scarlet Minivet indicates that there is little top canopy remaining and no trend of canopy species can be determined. Because the surveys in 2015 took place much later than in 2016 and 2018, the 2016 population densities should be considered the baseline for this site, and changes between 2016 and 2018 were considered for the comments made above.

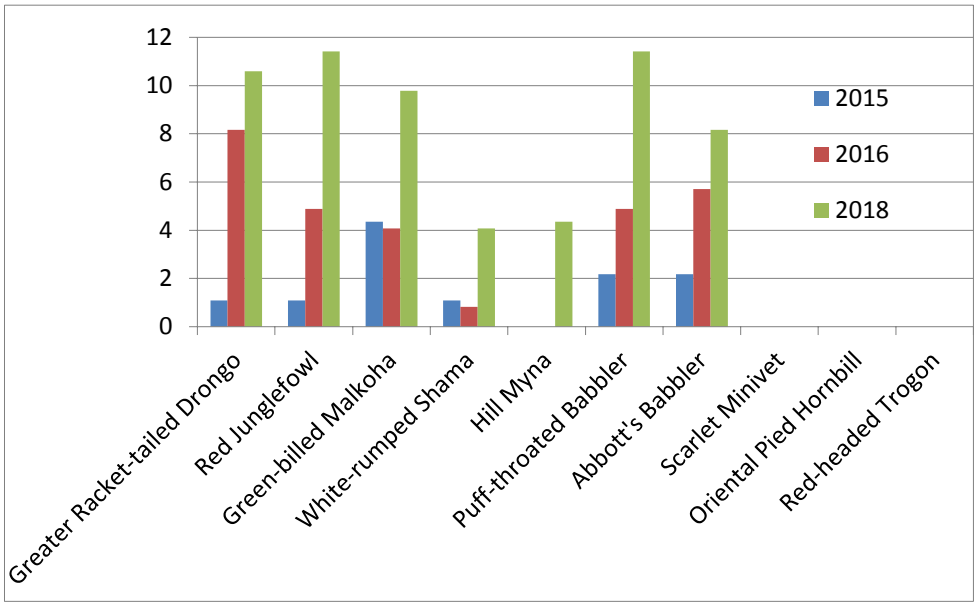

Fig. 3.5: Density of indicator birds (birds/km²) in Baroiyadhala National Park in 2015, 2016 and 2018.

3.3 Cox's Bazar Region

3.3.1 Fashiakhali Wildlife Sanctuary

Out of 11 indicator species, ten were monitored since 2009, but only eight were recorded in 2018. The longer term (9-year) trends indicate increasing populations of ground and undergrowth species but declining mid-level species since 2009 (Table 3.8). The only species achieving their highest numbers in the last year were Red Junglefowl and Scarlet Minivet (Fig. 3.6). Over the four years of change with CREL support species of all strata would appear to have increased substantially, but this is to some extent misleading as mid-level species recovered, and one canopy species (Hill Myna) became locally extinct after 2010 (Table 3.9), while another potential canopy indicator has never been recorded here (Oriental Pied Hornbill).

Table 3.8 Average indicator bird population trends in Fashiakhali WS (% change pa)

Strata	9 year	4 year
Undergrowth/ground	5.44	41.47
Mid-level	-4.63	22.30
Canopy	0.53	37.45

Table 3.9 Trends in bird populations in Fashiakhali WS

Species	% change pa*	
	9 years	4 years
Greater Racket-tailed Drongo	-8.57	-10.6
Crested Serpent Eagle	21.14	39.2
Red Junglefowl	10.83	100.1
Green-billed Malkoha	7.39	124.7
White-rumped Shama	-10.04	-25.0
Hill Myna	-11.11	none
Puff-throated Babbler	13.62	11.8
Abbott's Babbler	-8.11	12.5
Scarlet Minivet	12.18	37.5
Crimson Sunbird	-7.29	0.1

* Percentage change in density standardized per year based on: 9 years = mean of 2016 and 2018 compared with mean of 2009 and 2010; 4 years = 2018 compared with mean of 2014 and 2015.

Overall mid-strata birds (Greater Racket-tailed Drongo, Green-billed Malkoha) show fluctuating populations since 2009. The pattern for undergrowth and ground cover species is also unclear, with Red Junglefowl and Puff-throated Babbler increasing over time, but the density of Abbot's Babbler and White-rumped Shama declining over nine years. In general regeneration of saplings and smaller trees and undergrowth may have undergone minor degradation or been stable over this period. The loss of Hill Myna (only recorded in 2009 and 2010) and absence of Oriental Pied Hornbill (both canopy species nesting in holes in large trees) indicate the scarcity of mature and large trees and possibly continued illegal logging.

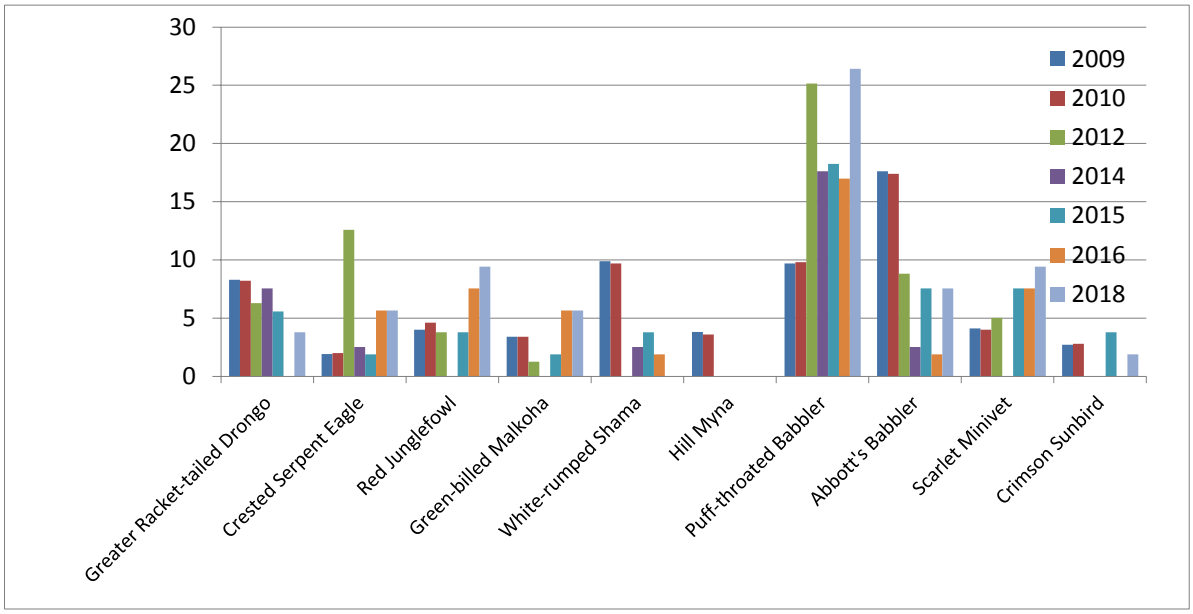

Fig. 3.6: Density of indicator birds (birds/km²) in Fashiakhali Wildlife Sanctuary during 2009 to 2018.

3.3.2 Medakacchapia National Park

This site is close to Fashiakali WS and shows some similar trends, but considering the period since 2009 indicator birds for all three strata (undergrowth, mid-level and canopy) have declined at average rates of 6-11% per year (Table 3.10) suggesting a worsening condition to this forest. During the period of CREL support undergrowth and ground birds recovered to some extent, but by 2014 all mid-level indicator birds had been lost from the site – the forest now comprises a canopy of Garjan trees and recovering undergrowth, with a lack of intermediary small trees, moreover canopy species have declined faster in these four years with Hill Myna now lost (Table 3.11) and Scarlet Minivet continuing to decline.

Table 3.10 Average indicator bird population trends in Medakacchapia NP (% change pa

Strata	9 year	4 year
Undergrowth/ground	-7.19	17.97
Mid-level	-10.19	lost
Canopy	-6.84	-15.64

Table 3.11 Trends in bird populations in Medakacchapia NP

Species	% change pa*	
	9 years	4 years
Greater Racket-tailed Drongo	-11.11	none
Crested Serpent Eagle	-6.57	-25.0
Red Junglefowl	-11.11	-25.0
Green-billed Malkoha	-8.48	-25.0
White-rumped Shama	-10.06	none
Hill Myna	-11.11	none
Puff-throated Babbler	-2.10	-8.8
Abbott's Babbler	-8.35	87.7
Scarlet Minivet	-2.57	-15.6
Crimson Sunbird	-11.11	none

* Percentage change in density standardized per year based on: 9 years = mean of 2016 and 2018 compared with mean of 2009 and 2010; 4 years = 2018 compared with mean of 2014 and 2015.

The populations of undergrowth dependent species (Puff-throated Babbler, Abbott's Babbler and Red Junglefowl) have all dropped over nine years, indicating further degradation of forest undergrowth, although Abbott's Babbler partially recovered during CREL (Fig. 3.7). Continuous absence of Greater Racket-tailed Drongo and Crimson Sunbird since 2009 and 2010 suggest the quality of the middle strata has been degraded since 2010. Presence of Scarlet Minivet (shows fluctuations between years), disappearance of Hill Myna, and lack of any record of Oriental Pied Hornbill also suggest the upper strata is deteriorating.

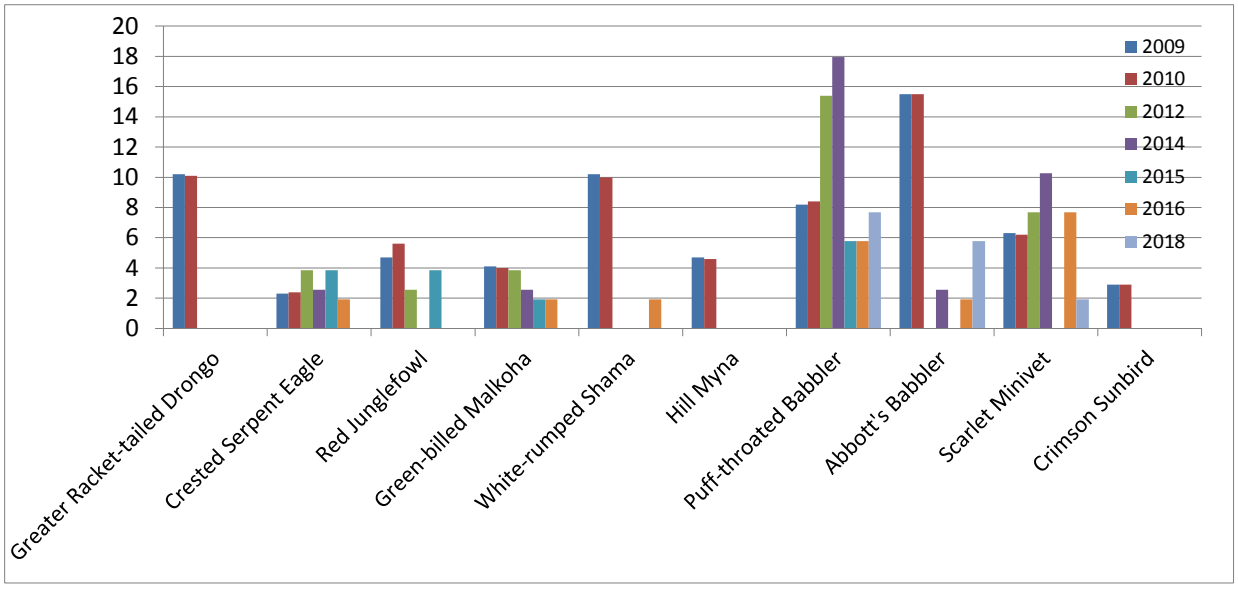

Fig. 3.7: Density of indicator birds (birds/km²) in Medakacchapia National Park 2009 to 2018.

3.3.3 Himchari National Park

Table 3.12 Average indicator bird population trends in Himchari NP (% change pa)

Strata	4 years
Undergrowth/ground	14.80
Mid-level	-11.35
Canopy	-25.00

Although co-management was introduced in Himchari National Park during IPAC, it was only added to the forest bird monitoring scheme in 2014 under CREL when two transects were established in June 2014 covering 4.87 km. Only six indicator bird species have been recorded, and only five of these were recorded in 2018, up from three in 2016 (Fig. 3.8). Canopy and mid-level species are largely absent reflecting the absence of trees from much of the NP. Considering the four years Puff-throated Babbler, Abbott's Babbler and Red Junglefowl are maintaining their populations and ground-undergrowth species appear to be increasing (Table 3.12) indicating some possible recovery of habitat. In 2018 Greater Racket-tailed Drongo and Green-billed Malkoha were recorded indicating some improvement in undergrowth. However, low densities of all other indicator species indicate the poor quality of forest habitat here which is largely scrubby vegetation and the few mid-level and canopy species recorded have declined.

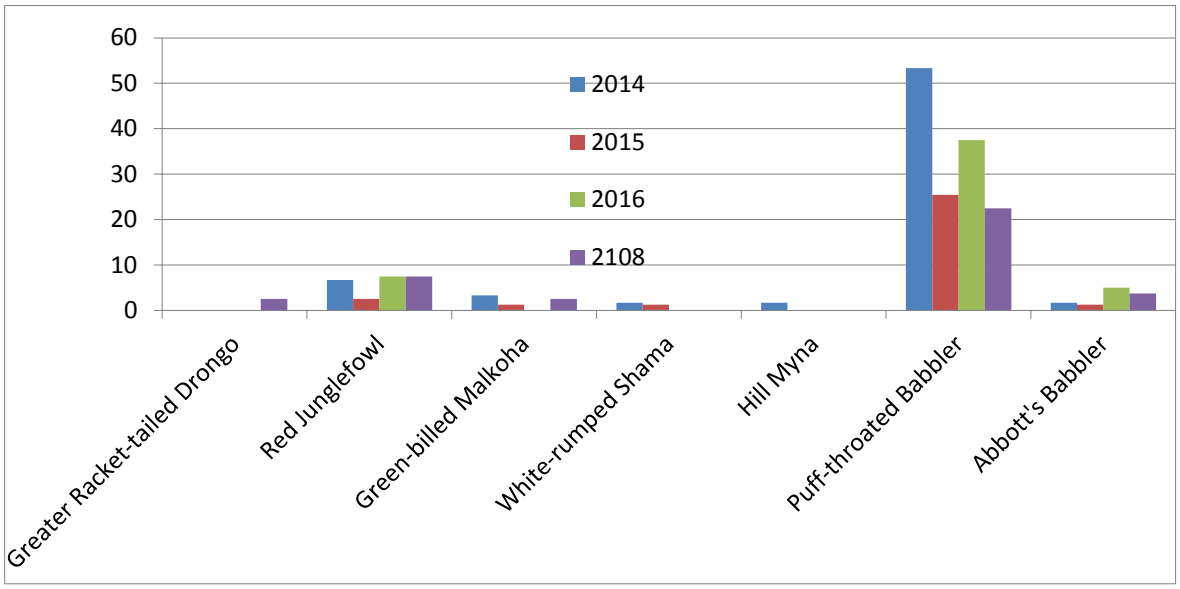

Fig. 3.8: Density of indicator birds (birds/km²) in Himchari National Park during 2014 to 2018.

3.3.4 Inani Reserve Forest

Table 3.13 Average indicator bird population trends in Inani RF (% change pa)

Strata	4 years
Undergrowth/ground	36.12
Mid-level	1.38
Canopy	-25.00

Although there have been initiatives to establish co-management through different project initiatives since around 2009, the area is not formally a protected area and monitoring of forest birds was only introduced in 2014 under CREL when two transects were established in June 2014 covering 4.87 km. Nine indicator species have been recorded and seven of these were recorded in the last survey year, 2018 (Fig 3.9). Records of top and middle strata species such as Oriental Pied Hornbill and Crimson Sunbird (both first recorded in 2016 since surveys started), Hill Myna, Green-billed Malkoha, Greater Racket-tailed Drongo and White-rumped Shama indicate that the forest held some taller trees with moderate understory. However, no canopy indicator species (Oriental Pied Hornbill, Hill Myna, Scarlet Minivet) were recorded in 2018, and canopy species have declined rapidly during four years (Table 3.13). The high number of Puff-throated Babbler (although numbers appear to be rapidly declining), increasing trend of Abbott's Babbler and appearance of Red Junglefowl result in an increasing trend for ground and undergrowth species suggesting recovery of undergrowth.

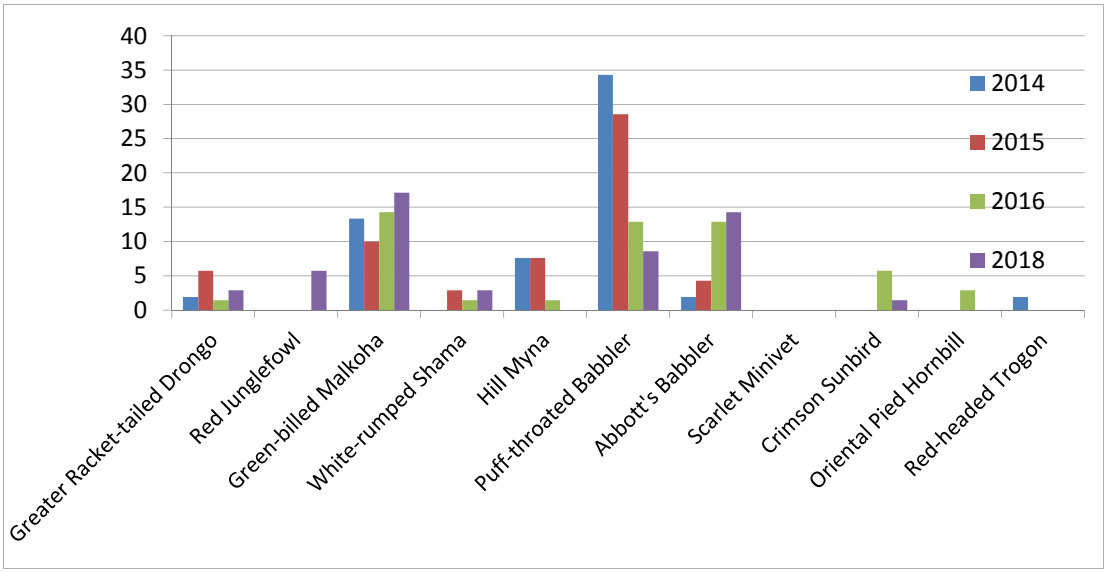

Fig. 3.9: Density of indicator birds (birds/km²) in Inani Reserve Forest during 2014 to 2018.

3.3.5 Teknaf Wildlife Sanctuary

Seven species were monitored throughout this 13 year period, and one (Green-billed Malkoha) out of two additional species searched for from 2014 has been recorded (Fig. 3.10). All three categories of indicator birds have declined over 13 years indicating a general decline in forest condition, but during 2014-2018 undergrowth and ground species in particular showed some recovery (Table 3.14) although this was entirely due to a modest increase in Red Junglefowl (Table 3.15) from zero in 2014, but their population still remains much less than during 2005-12.

Table 3.14 Average indicator bird population trends in Teknaf WS (% change pa)

Strata	13 year	4 year
Undergrowth/ground	-0.08	27.38
Mid-level	-7.42	6.02
Canopy	-7.69	-25.00

Table 3.15 Trends in bird populations in Teknaf WS

	% change pa*	
Species	**13 years**	**4 years**
Greater Racket-tailed Drongo	-6.88	20.1
White-crested Laughingthrush		
Red Junglefowl	-4.80	58.1
Green-billed Malkoha (2014 on)	Ns	23.0
White-rumped Shama	-7.69	
Hill Myna	-7.69	-25.0
Puff-throated Babbler	4.65	-3.3
Scarlet Minivet (2014 on)	Ns	
Oriental Pied Hornbill	-7.69	-25.0
Red-headed Trogon	-7.69	-25.0

* Percentage change in density standardized per year based on: 13 years = mean of 2016 and 2018 compared with mean of 2005 and 2006; 4 years = 2018 compared with mean of 2014 and 2015

Ns – not surveyed before CREL so not calculable

Since 2005, the loss or large reduction in density of Greater Racket-tailed Drongo, White-rumped Shama, Red-headed Trogon; Hill Myna and Oriental Pied Hornbill indicates continued diminution of middle and higher tree strata. The increase in Puff-throated Babbler number contrasts with declining over 13 years of Red Junglefowl (although over the last four years these two species show opposite trends), so there is no clear trend for understory and ground birds, whereas mid-level and canopy species have on average declined at about 7% a year over 13 years.

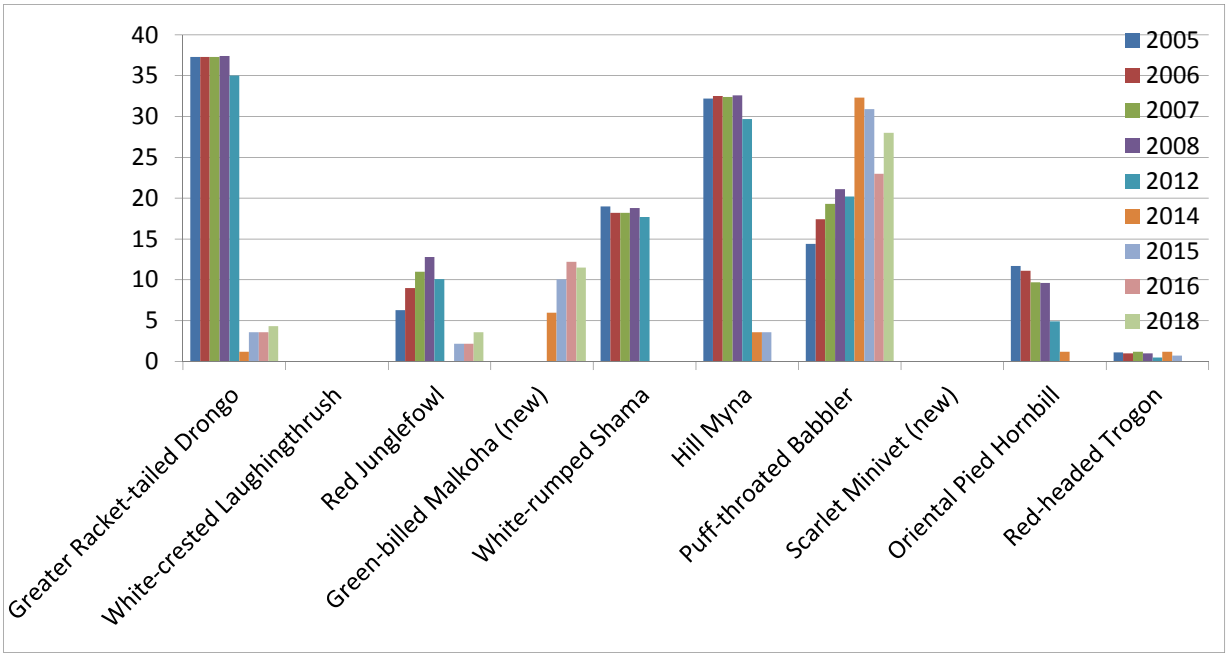

Fig. 3.10: Density of indicator birds (birds/km²) in Teknaf Wildlife Sanctuary from 2005 to 2016.

3.4 Sylhet Region

3.4.1 Lawachara National Park

All but one indicator species (Oriental Pied Hornbill) were recorded during transects in Lawachara National Park in 2018. Out of ten monitored species seven have been monitored since 2005 and three were added in 2014. Overall, since 2005 populations of undergrowth species have increased slightly, but middle level and canopy indicator species have declined at on average about 2-3% per year (Table 3.16). Although during the last four years with CREL support indicator species for all three forest strata have increased, the high rate of increase for canopy species is entirely due to the large increase in Scarlet Minivet numbers in 2018 (see Table 3.17, this is a species not surveyed before 2014).

Table 3.16 Average indicator bird population trends in Lawachara NP (% change pa)

Strata	13 year	4 year
Undergrowth/ground	3.72	14.82
Mid-level	-2.12	4.75
Canopy	-3.75	73.90

Table 3.17 Trends in bird populations in Lawachara NP

Species	% change pa*	
	13 years	4 years
Greater Racket-tailed Drongo	-0.31	7.4
Red-headed Trogon	-2.39	26.6
Red Junglefowl	8.48	43.4
Green-billed Malkoha (2014 on)	Ns	-15.8
White-rumped Shama	-3.67	0.7
Hill Myna	-0.19	7.2
Puff-throated Babbler	-1.03	-10.7
Abbot's Babbler (2014 on)	Ns	11.8
Scarlet Minivet (2014 on)	Ns	239.4
Oriental Pied Hornbill	-7.32	-25.0

* Percentage change in density standardized per year based on: 13 years = mean of 2016 and 2018 compared with mean of 2005 and 2006; 4 years = 2018 compared with mean of 2014 and 2015

Ns – not surveyed before CREL so not calculable

Overall the population of undergrowth species appears to be healthy, for example, Red Junglefowl has increased overall despite a dip in numbers in 2015, Puff-throated Babbler has shown little trend, and Abbot's Babbler appears to be increasing (Fig. 3.11). Mid-level species populations have been largely static, for example although Red-headed Trogon was not recorded in the surveys in 2015-2016 it was recorded in 2018 and for this scarce species numbers are little changed, numbers of Greater Racket-tailed Drongo are stable, but White-rumped Shama numbers fell in 2014-2018 to about half the numbers in 2005-2012). The health of the upper strata of the forest is also a concern - although Hill Myna numbers appear to be stable, there were no sightings of Scarlet Minivet in 2016 and the Oriental Pied Hornbill population has steadily declined throughout the past

11 years with no record in 2018 (indicating a shortage or decline in safe nesting crevices in large old trees and/or large fruiting trees).

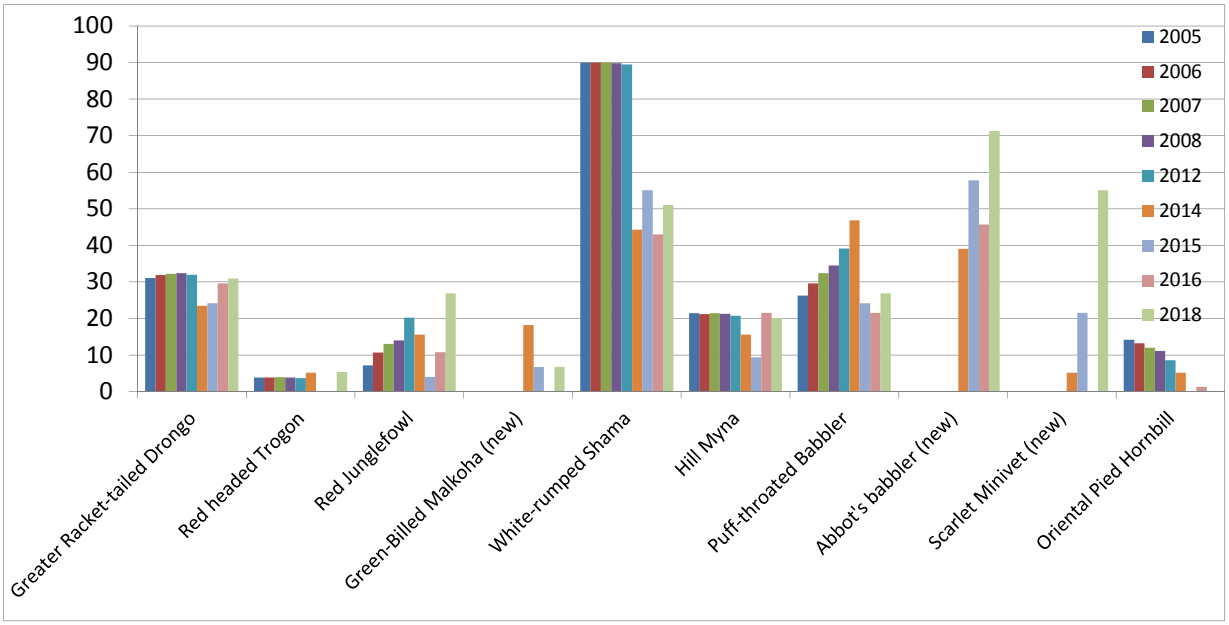

Fig. 3.11 Density of indicator birds (birds/km²) in Lawachara National Park from 2005 to 2018.

Any impacts from co-management appear to be mixed – undergrowth may be recovering there appears to be continued long term degradation of mid-level and canopy cover (even if birds using these strata have recovered in the last four years). An additional factor that could impact bird populations is disturbance from visitors whose numbers have increased over time and also are now visiting in greater numbers during the nesting season.

3.4.2 Satchari National Park

Satchari NP is one of very few of the surveyed forests where there is a generally increasing trend in indicator bird populations, apart from recent declines in mid-level species (Table 3.18). Only two species have declined since 2005: Red-headed Trogon (but this is the scarcest of the indicator species) and Oriental Pied Hornbill, which appears to be recovering since 2014 (Table 3.19). The 2018 survey findings showed notable increases in Hill Myna and smaller but continued increases in Abbott's Babbler and Red Junglefowl populations, the first is a canopy species dependent on holes in large trees for nesting, the other two species are undergrowth or mid-story species (Fig 3.12).

Table 3.18 Average indicator bird population trends in Satchari NP (% change pa)

Strata	13 year	4 year
Undergrowth/ground	21.47	7.93
Mid-level	-1.67	-10.37
Canopy	12.27	38.34

Table 3.19 Trends in bird populations in Satchari NP

	% change pa*	
Species	**13 years**	**4 years**
Greater Racket-tailed Drongo	0.57	-9.5
Red-headed Trogon	-7.69	-25.0
Red Junglefowl	36.36	14.7
Green-billed Malkoha (2014 on)	Ns	-17.5
White-rumped Shama	2.10	10.5
Hill Myna	27.14	35.0
Puff-throated Babbler	6.57	-9.4
Abbot's Babbler (2014 on)	Ns	18.5
Scarlet Minivet (2014 on)	Ns	25.0
Oriental Pied Hornbill	-2.60	55.0

* Percentage change in density standardized per year based on: 13 years = mean of 2016 and 2018 compared with mean of 2005 and 2006; 4 years = 2018 compared with mean of 2014 and 2015

Ns – not surveyed before CREL so not calculable

For undergrowth and ground birds this is part of a longer trend. The increasing densities of ground-understory dwellers (Red Junglefowl and Puff-throated Babbler) averaging 21% a year since 2005 (Table 3.19), as well as more recent increases for two low strata species (White-

rumped Shama and Abbott's Babbler) since 2014, presumably indicate forest regeneration and improved ground and undergrowth vegetation. The health of the canopy also shows a positive trend as the populations of all top canopy species (Hill Myna, Oriental Pied Hornbill and Scarlet Minivet) appear to have improved in recent years. However, there has been little change in mid-story bird populations.

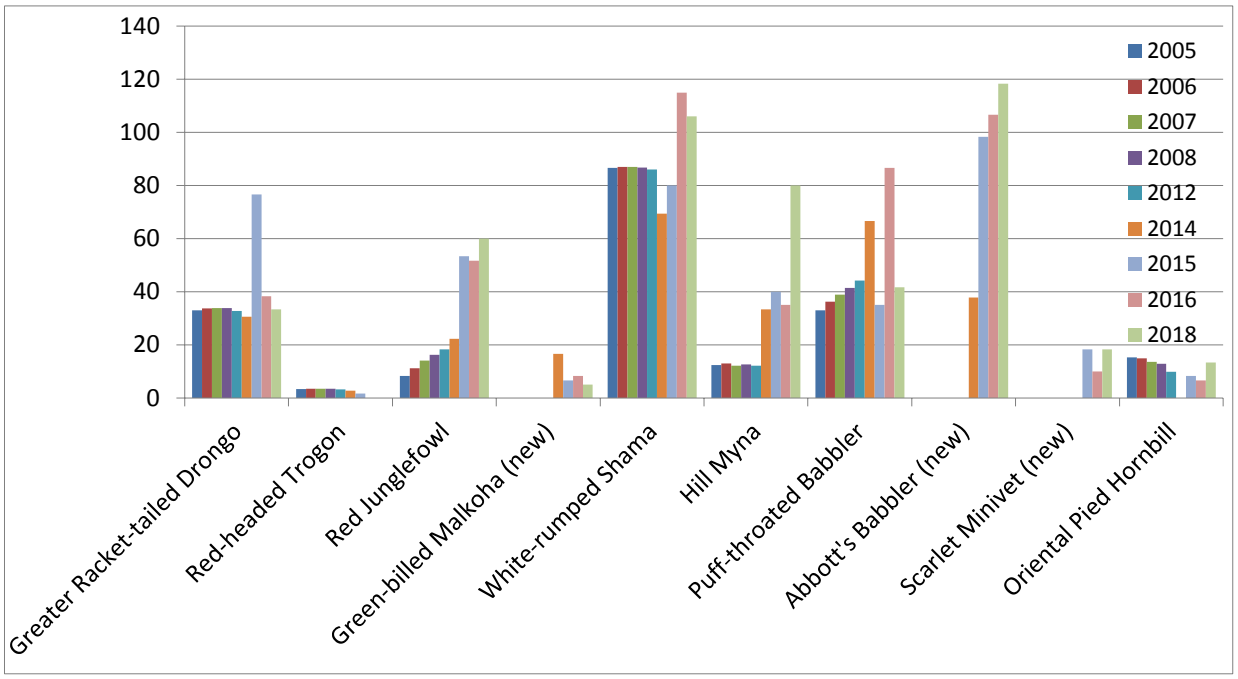

Fig. 3.12 Density of indicator birds (birds/km²) in Satchari National Park from 2005 to 2018.

Overall, populations almost all indicator birds show positive trend at Satchari, which indicate that the health of forest is generally improving. Recently introduced visitor facilities (watchtower, trails, etc.) may have encouraged further the Satchari CMC to strengthen active protection of the forest, while visitor numbers may discourage cutting of trees and undergrowth.

3.4.3 Rema-Kalenga Wildlife Sanctuary

Overall ground/undergrowth, mid-level and canopy species have all averaged positive trends considering 13 years (for example 8% increase per year for undergrowth and 10% increase per year for canopy species) (Table 3.20), but averaging across species masks some negative trends (Table 3.21). In addition there are between year fluctuations, for example in 2015 a major decline was observed in two understory babblers - Puff-throated Babbler and Abbott's Babbler – but numbers bounced back in 2016-18 (Fig. 3.13). The density of Red Junglefowl has continued an increasing trend since 2005 into 2018, suggesting regeneration of ground and undergrowth vegetation, and also reduced hunting pressure. Densities of three middle strata species (Greater Racket-tailed Drongo, Green-billed Malkoha and Red-headed Trogon) show increasing trends to 2018. Among

Table 3.20 Average indicator bird population trends in Rema-Kalenga WS (% change pa)

Strata	13 year	4 year
Undergrowth/ground	8.86	9.33
Mid-level	4.54	25.13
Canopy	10.01	35.77

Table 3.21 Trends in bird populations in Rema-Kalenga WS

Species	% change pa*	
	13 years	4 years
Greater Racket-tailed Drongo	5.50	34.3
Red Junglefowl	16.62	22.4
Green-billed Malkoha (new)	Ns	46.1
White-rumped Shama	-5.37	0.9
Hill Myna	27.71	23.0
Puff-throated Babbler	1.11	5.0
Abbott's Babbler (new)	Ns	0.6
Scarlet Minivet (new)	Ns	109.3
Red-headed Trogon	13.49	19.2
Oriental Pied Hornbill	-7.69	-25.0

* Percentage change in density standardized per year based on: 13 years = mean of 2016 and 2018 compared with mean of 2005 and 2006; 4 years = 2018 compared with mean of 2014 and 2015

Ns – not surveyed before CREL so not calculable

top canopy species (Hill Myna) has increased substantially since 2012, and Scarlet Minivet is also increasing, but Oriental Pied Hornbill numbers have declined and none were recorded in 2016 or 2018. Overall the surveys suggest that forest condition is improving to some extent, but the apparent recent loss of Oriental Pied Hornbill is a concern as this is a species that helps to disperse seeds of large fruiting trees.

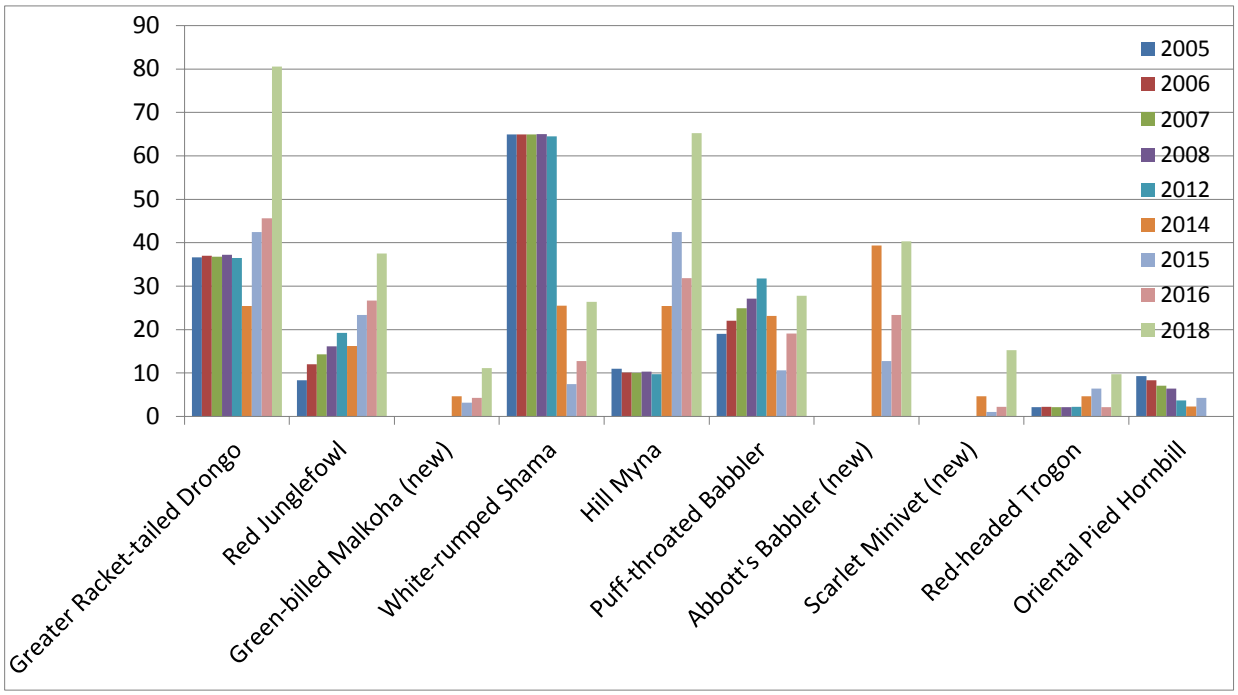

Fig. 3.13 Density of indicator birds (birds/km²) in Rema-Kalenga Wildlife Sanctuary from 2005 to 2018.

3.4.4 Khadimnagar National Park

Overall indicator bird populations representing all three strata have increased since 2009, with most of the increases for undergrowth species occurring in the earlier years, and most of the increases for mid-level and canopy species taking place during CREL (Table 3.22). However, as Table 3.23 shows some of the individual species have fluctuated in numbers making annual percentage change calculations more affected by starting or ending population densities and so less reliable (for example high numbers of Crested Serpent Eagle were recorded in 2016 but none in 2014, 2015 or 2018 giving the apparently contradictory findings of a generally increasing trend but none in the last four years, in reality (as Fig 3.14 shows) small numbers have been present in several years.

Table 3.22 Average indicator bird population trends in Khadimnagar NP (% change pa)

Strata	9 year	4 year
Undergrowth/ground	31.60	-1.94
Mid-level	6.78	83.63
Canopy	2.64	53.76

Table 3.23 Trends in bird populations in Khadimnagar NP

	% change pa*	
Species	**9 year**	**4 year**
Greater Racket-tailed Drongo	-10.07	25.0
Crested Serpent Eagle	21.73	None
Red Junglefowl	-5.56	-12.5
Green-billed Malkoha	3.22	25.0
White-rumped Shama	33.07	10.0
Hill Myna	-9.27	None
Puff-throated Babbler	43.33	-8.3
Abbott's Babbler	57.02	15.0
Scarlet Minivet	14.55	53.8
Crimson Sunbird	0.91	274.5

* Percentage change in density standardized per year based on: 9 years = mean of 2016 and 2018 compared with mean of 2009 and 2010; 4 years = 2018 compared with mean of 2014 and 2015.

Sharp increases in Abbott's Babbler, and White-rumped Shama numbers particularly since 2012 compared with earlier years (Fig. 3.14), outweigh slightly declining Red Junglefowl numbers, and suggest overall an improvement of scrubby and bushy habitat. Undergrowth and ground species have averaged 31% per year increases over nine

years. The population trends for middle strata species are mixed, and the recent rapid increase shown in Table 3.22 is biased by recovery of small numbers of Crimson Sunbird, there is probably in fact little change in the middle stratum. However, the continuous absence of Oriental Pied Hornbill and Hill Myna show little change in the canopy, recent increases are entirely due to the increase in Scarlet Minivet in 2018.

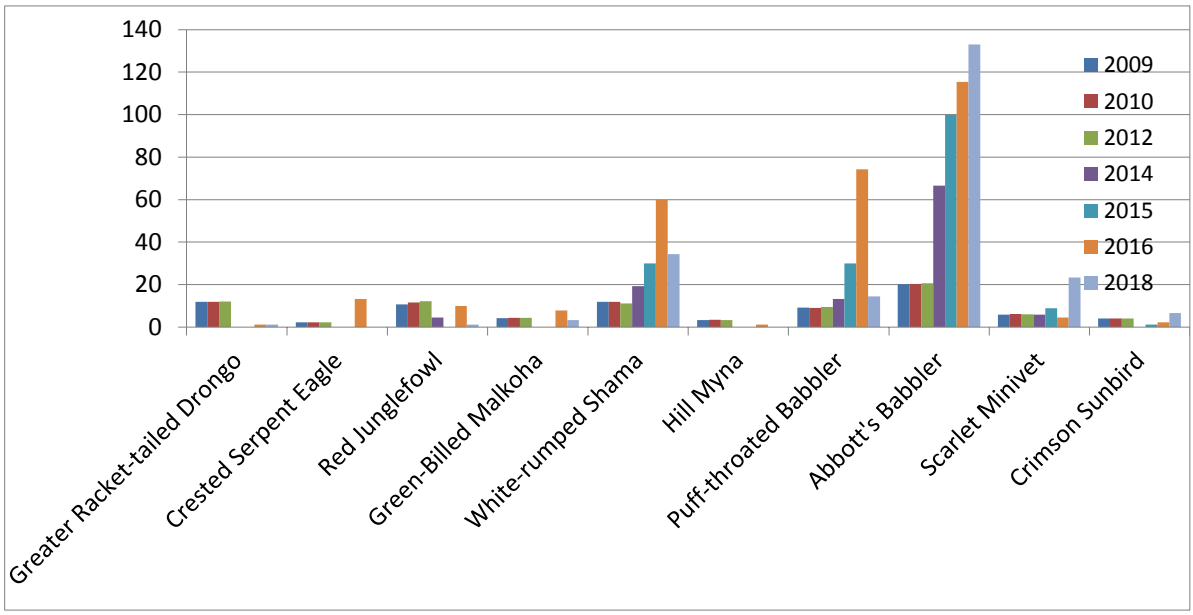

Fig. 3.14 Density of indicator birds (birds/km²) in Khadimnagar National Park from 2009 to 2018.

3.5 Central Region - Madhupur National Park

Unlike all of the other forests monitored, Madhupur NP comprises deciduous forest dominated by Sal *Shorea robusta*, consequently some of the standard indicator species do not occur in this type of forest and from the outset of monitoring in 2009 a slightly different set of indicator species was selected and monitored by adding Hair-crested Drongo (mid-level) and Black-crested Bulbul (higher mid-level to canopy species) instead of Greater Racket-tailed Drongo and Oriental Pied Hornbill. Also an additional ground/understory indicator species (Orange-headed Thrush) was added by CREL.

Table 3.24 Average indicator bird population trends in Madhupur NP (% change pa)

Strata	9 year	4 year
Undergrowth/ground	11.34	25.75
Mid-level	10.38	25.62
Canopy	-10.24	lost

Table 3.25 Trends in bird populations in Madhupur NP

	% change pa*	
Species	**9 year**	**4 year**
Crested Serpent Eagle	-2.48	-3.1
Red Junglefowl	6.24	29.2
Green-billed Malkoha	1.15	25.4
Hair-crested Drongo	17.89	2.9
White-rumped Shama	29.63	12.0
Black-crested Bulbul	-9.37	lost
Puff-throated Babbler	16.44	22.3
Orange-headed Thrush (2014 on)	Ns	64.9
Scarlet Minivet	-11.11	lost
Crimson Sunbird	-7.16	62.2

* Percentage change in density standardized per year based on: 9 years = mean of 2016 and 2018 compared with mean of 2009 and 2010; 4 years = 2018 compared with mean of 2014 and 2015.
Ns – not surveyed before CREL so not calculable

Over nine years on average the density of ground/undergrowth and middle strata species has increased by about 10% per year (Table 3.24), with a more rapid increase in the last four years of 25% per year. The data suggest better health of the lower and mid strata of the forest, for example White-rumped Shama, Puff-throated Babbler, Hair-crested Drongo, Orange-headed Thrush, Red Junglefowl have all increased substantially (Table 3.35, Fig. 3.15). Despite some recent recovery, the decline in the nectar feeder (Crimson Sunbird), suggests a lack of flowering species. The absence or reduction in top strata species - Scarlet Minivet and Black-crested Bulbul - has been observed since

2012 (Fig 3.15) averaging a loss of 10% per year averaged over nine years, but in reality these species were lost by 2014 indicating the loss of mature and large trees, which will take many years to recover.

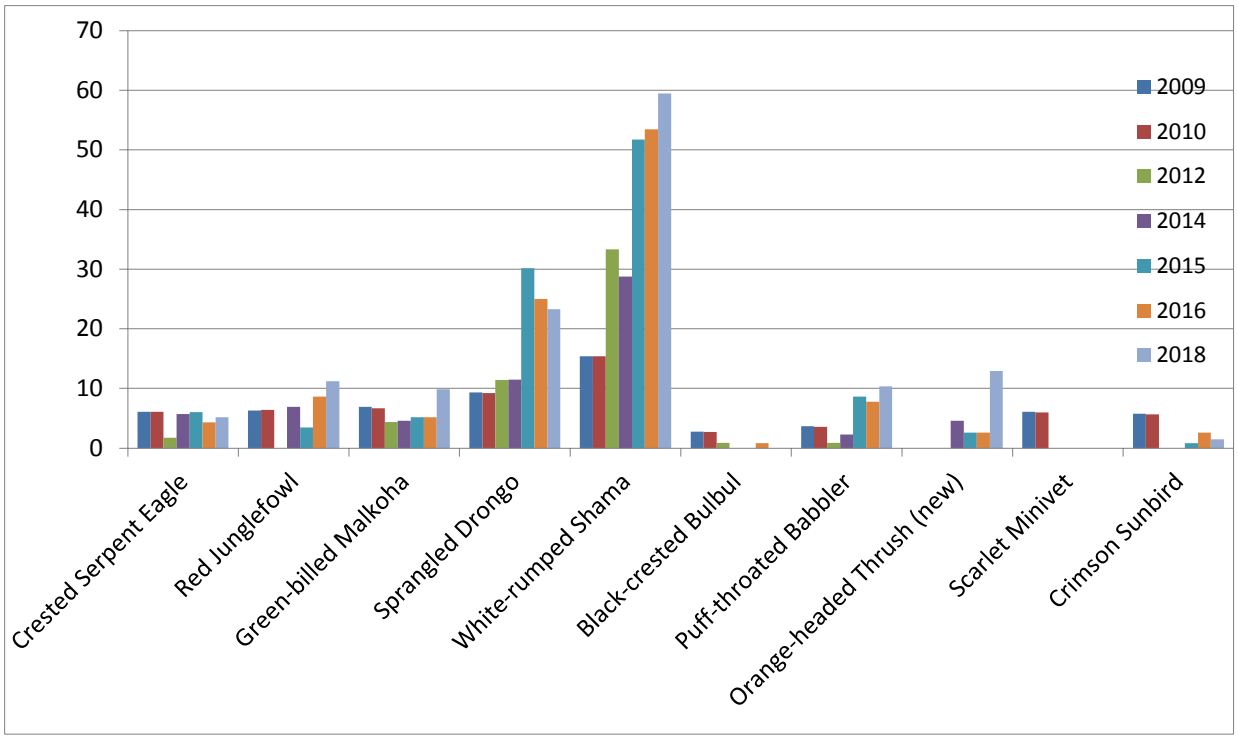

Fig. 3.15 Density of indicator birds (birds/km²) in Madhupur National Park from 2009 to 2018.

CHAPTER 4 CONCLUSION AND RECOMMENDATIONS

4.1 Comparison of Indicator Birds between Sites

4.1.1 Comparison of population densities

The average of 2016 and 2018 density estimates was calculated to represent the most recent population densities of the indicator species, allowing for local fluctuations in numbers by averaging over two years. In only four sites were all of the indicator species selected for that site recorded in the last two years of surveys – Kaptai NP, Dudpukuria-Dhopachari WS, Hazarikhil WS, and Lawachara NP indicating diverse forest bird faunas although few of the indicator species reached their highest population densities in these sites. Comparing PAs, Satchari NP has the highest densities of almost all species surveyed (eight out of ten including ground and undergrowth, mid-level and canopy species) but had lost Red-headed Trogon in the last two survey years, with Rema-Kalenga WS (also in the northeast) also having high densities of four indicator species (Table 4.1).

Satchari NP has the highest densities of all three undergrowth/ground indicator species and Khadimnager NP also has high densities of both undergrowth babblers. In these two sites populations of Abbott's Babbler were estimated to exceed 100 birds per km^2, making this the most abundant of the species monitored in these sites, while in general Abbott's Babbler was the most abundant species of those surveyed. Undergrowth indicator species were absent from very few sites, but on average population densities were lowest in the Cox's Bazar sites.

The variation between sites in densities of mid-level species was less, but Satchari NP and Rema-Kalenga WS each held the highest densities of two species, suggesting a better forest structure there. But six other sites held among the highest population densities of one indicator species for this strata. In Himchari NP, Medakacchapia NP, and Teknaf WS (all in Cox's Bazar region) two or more mid-level species were absent, indicating poor forest structure.

Satchari NP also held the highest densities of all three canopy indicator species surveyed. Other sites holding high population densities of one canopy indicator species were: Lawachara NP and Rema-Kalenga WS (both in northeast) and Hazarikhil WS in Chittagong region. These four sites therefore still have relatively intact forest canopy. At the other extreme no canopy indicator species were recorded in Chunati WS, Himchari NP and Teknaf WS, indicating some of the poorest forest condition lacking sufficient large trees. All of the other Cox's Bazar region sites as well as Baroiyardhala NP held very low numbers of canopy species - all in the southeast and having suffered significant loss of mature trees in the past.

Hence overall out of the 15 sites surveyed Satchari NP as of 2016-18 held high densities of the indicator species in general representing all three forest strata and indicating that this small site held some of the healthiest bird populations and by implication the most intact forest of the sites monitored. However, the small size of this PA makes it vulnerable to external pressures which could push species below critical population sizes needed to sustain themselves.

At the other extreme, Himchari NP, Medakacchapia NP and Teknaf WS were each missing five or six of the indicator species and in general have very low population densities for those species recorded, including undergrowth, mid-level and canopy species. This suggests that these sites have some of the poorest quality forest among these PAs. This reflects modest undergrowth, a lack of regenerating mid-level trees, and a lack of canopy trees (or in the case of Medakacchapia a single species canopy of Garjan *Dipterocarpus turbinatus* presumably lacking in diversity that would support a healthy avifauna).

Table 4.1 Most recent density estimates (birds/km^2) of indicator species, averaging 2016 and 2018.

Species	Strata	Chittagong					Cox's Bazar					Northeast				Central	Average
		Chunati	Kaptai	Dudpu-kuria	Hazari-khil	Baroiar-dhala	Fasia-khali	Meda-kacchapia	Him-chari	Inani	Teknaf	Lawa-chara	Sat-chari	Rema-Kalenga	Khadim-nagar	Modhu-pur	
Red Junglefowl	low	11.64	5.69	4.92	18.75	8.16	8.49	0.00	7.50	2.86	2.88	18.82	55.84	32.08	5.55	9.92	12.87
Puff-throated Babbler	low	20.66	21.63	22.95	41.25	8.16	21.70	6.73	30.00	10.72	25.51	24.20	64.17	23.45	44.35	9.05	24.97
Abbott's Babbler	low	ns	11.38	7.38	18.75	6.94	4.72	3.85	4.38	13.58	ns	58.47	112.50	31.82	124.17	ns	33.16
White-crested Laughingthrush	low	0.00	ns	ns	ns	ns	ns	ns	ns	ns	0.00	ns	ns	ns	ns	ns	0.00
Orange-headed Thrush	low	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	7.76	7.76
Green-billed Malkoha	mid	8.04	15.94	4.10	5.00	6.94	5.66	0.96	1.25	15.72	11.85	3.36	6.67	7.68	5.55	7.51	7.08
Red-headed Trogon	mid	1.19	ns	2.05	0.63	0.00	ns	ns	0.00	0.00	0.00	2.69	0.00	5.92	ns	ns	1.25
Greater Racket-tailed Drongo	mid	10.92	23.52	10.66	24.38	9.38	1.89	0.00	1.25	2.15	3.96	30.24	35.83	63.11	1.11	ns	15.60
Hair-crested Drongo	mid	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	24.14	24.14
White-rumped Shama	mid	1.86	14.80	17.21	13.13	2.45	0.95	0.96	0.00	2.15	0.00	47.05	110.54	19.57	47.12	56.47	22.28
Crimson Sunbird	mid	ns	3.04	1.64	4.38	ns	0.95	0.00	0.00	3.57	ns	ns	ns	ns	4.44	2.05	2.23
Oriental Pied Hornbill	canopy	0.00	4.55	2.05	5.00	0.00	0.00	0.00	0.00	1.43	0.00	0.67	10.00	0.00	0.00	ns	1.69
Scarlet Minivet	canopy	0.00	0.76	5.74	9.38	0.00	8.49	4.81	0.00	0.00	0.00	27.56	14.17	8.75	13.86	0.00	6.23
Black-crested Bulbul	canopy	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	0.43	0.43
Hill Myna	canopy	0.00	9.11	11.07	5.00	2.18	0.00	0.00	0.00	0.72	0.00	20.84	57.50	48.55	0.56	ns	11.11
Crested Serpent Eagle	na	ns	2.66	ns	ns	ns	5.66	0.96	ns	ns	ns	ns	ns	ns	6.65	4.74	4.13
No. species searched but none		4	0	0	0	3	2	5	6	2	6	0	1	1	1	1	
% species not found		40.0	0.0	0.0	0.0	30.0	18.2	45.5	54.5	18.2	60.0	0.0	10.0	10.0	9.1	10.0	

ns - not surveyed (not selected as an indicator for this site including species not found in that region)
na – not applicable, species not assigned to a forest strata as it makes use of all strata
Yellow: species surveyed but absent in 2016 and 2018
Green: one of the two highest densities recorded for that species (considering only species surveyed in a majority of sites)

Table 4.2 Percentage change per year in density of birds (number/km^2) for sites with a longer series of data

Species	Strata	Chittagong		Cox's Baxar			Northeast				Central
		Chunati	Kaptai	Fasiakhali	Medakacchapia	Teknaf	Lawachara	Satchari	Rema-Kalenga	Khadimnagar	Modhupur
		13 year	9 year	9 year	9 year	13 year	13 year	13 year	13 year	9 year	9 year
Red Junglefowl	low	-0.3	1.8	10.8	-11.1	-4.8	8.5	36.4	16.6	-5.6	6.2
Puff-throated Babbler	low	6.5	1.8	13.6	-2.1	4.6	-1.0	6.6	1.1	43.3	16.4
Abbott's Babbler	low	ns	-2.0	-8.1	-8.4	ns	nd	nd	nd	57.0	ns
White-crested Laughingthrush	low	-7.7	ns	ns	ns	nr	ns	ns	ns	ns	ns
Orange-headed Thrush	low	ns	ns	ns	ns	ns	ns	ns	ns	ns	nd
Green-billed Malkoha	mid	nd	16.5	7.4	-8.5	nd	nd	nd	nd	3.2	1.2
Red-headed Trogon	mid	7.7	ns	ns	ns	-7.7	-2.4	-7.7	13.5	ns	ns
Greater Racket-tailed Drongo	mid	0.7	8.2	-8.6	-11.1	-6.9	-0.3	0.6	5.5	-10.1	ns
Spangled Drongo	mid	ns	ns	ns	ns	ns	ns	ns	ns	ns	17.9
White-rumped Shama	mid	-7.1	2.3	-10.0	-10.1	-7.7	-3.7	2.1	-5.4	33.1	29.6
Crimson Sunbird	mid	ns	-1.1	-7.3	-11.1	ns	ns	ns	ns	0.9	-7.2
Black-crested Bulbul	canopy	ns	ns	ns	ns	ns	ns	ns	ns	ns	-9.4
Oriental Pied Hornbill	canopy	nr	3.3	nd	nd	-7.7	-7.3	-2.6	-7.7	nd	ns
Scarlet Minivet	canopy	nd	-9.3	12.2	-2.6	nd	nd	nd	nd	14.5	-11.1
Hill Myna	canopy	-7.7	2.1	-11.1	-11.1	-7.7	-0.2	27.1	27.7	-9.3	ns
Crested Serpent Eagle	na	ns	0.0	21.1	-6.6	ns	ns	ns	ns	21.7	-2.5

Notes:
13 year: trend calculated as ((2016 and 2018 average minus 2005 and 2006 average) divided by 2005 and 2006 average) divided by 13 years
9 year: trend calculated as ((2016 and 2018 average minus 2009 and 2010 average) divided by 2009 and 2010 average) divided by 9 years
ns - not surveyed (not selected as an indicator for this site)
nd - insufficient data (added only in later years or not recorded in earliest years
nr - not recorded (selected as an indicator but never found during surveys)
na – not applicable, species not assigned to a forest strata as it makes use of all strata
green – increase of over 7.5% pa
red – decrease of over 7.5% pa
>7.5% pa change used for highlighting as over 13 years a -7.5% change approximates to disappearance of a species

4.1.2 Trends

Trends in indicator bird populations have mainly been estimated for the ten PAs where monitoring took place before CREL, but in addition for 14 of the PAs (including those monitored for longer) there was sufficient data to estimate recent trends during CREL project over the period 2014 to 2018. The short-term trends during CREL are analyzed after the medium term trends.

Data for nine or 13 years are now available for ten PAs, and trends in population densities of indicator bird species have been standardized as percentage changes per year in Table 4.2. Considering the longer term data as a whole, out of 84 species-site combinations with sufficient data to estimate a trend 45 (53%) have declined and 39 (46%) have increased. However, the rate of increase in some sites is greater than average rates of decline in others for several species, resulting in for example an average estimate of 2% per year increase in White-rumped Shama populations overall, even though this species declined in six sites and increased in four sites.

None of the indicator species surveyed in more than one site unequivocally increased during the monitoring periods – in some sites some species increased and in other sites the same species declined. However, Puff-throated Babbler increased in eight out of ten sites, and Red Junglefowl increased in six out of ten sites – both species forage largely on the ground.

Considering species-site combinations where substantial increases or decreases were found (the colored cells in Table 4.2), the situation in Medakacchapia NP is of great concern as seven species (including undergrowth, mid-level and canopy species) decreased greatly (by more than 67% over a nine year period) and no indicator species increased. Also of great concern is Teknaf WS where four species (of mid-level and canopy) decreased greatly, and only one species increased slightly. The pattern in Fashiakhali WS is difficult to determine as five species increased greatly and five species decreased greatly and any links between this instability in bird populations and forest habitat conditions are difficult to determine. Hence all three of the sites with a longer series of data located in Cox's Bazar region experienced rapid declines in 50% or more of their indicator bird species, confirming the stresses that these forests are under despite co-management. No other site had more than one or two species recording rapid declines. At the opposite extreme Khadimnagar NP had five species (two babblers, White-rumped Shama, Scarlet Minivet and Crested Serpent Eagle) recording rapid rates of increase, and only two species declining substantially, indicating that forest is recovering there. There are also positive signs for Rema-Kalenga WS and Modhupur NP where in both sites three species have increased substantially.

Combining species trends to calculate average trends for birds indicating the three forest strata (Table 4.3), four sites (Modhupur NP, Satchari NP, Rema-Kalenga WS and Khadimnagar NP), all in the north-east or north-central regions, show more positive than negative trends (and in two of these sites there were increases for all three forest strata) suggesting that protection under co-management is having positive impacts. In keeping with the species level trends noted above, indicator birds of all three strata on average declined in Medakacchapia NP and Teknaf WS which are the two PAs where forest condition has clearly been worsening, here protection measures

Table 4.3 Medium term percentage change per annum in population densities of indicator species, averaged across species according to main forest strata they use.

Protected Area	Years	Undergrowth/ ground	Mid-level	Canopy
Chunati	13 year	-0.5	0.4	-7.7
Kaptai	9 year	0.5	6.5	-1.3
Fasiakhali	9 year	5.4	-4.6	0.5
Medakacchapia	9 year	-7.2	-10.2	-6.8
Teknaf	13 year	-0.1	-7.4	-7.7
Lawachara	13 year	3.7	-2.1	-3.8
Satchari	13 year	21.5	-1.7	12.3
Rema-Kalenga	13 year	8.9	4.5	10.0
Khadimnagar	9 year	31.6	6.8	2.6
Modhupur	9 year	11.3	10.4	-10.2

Note: 13 or 9 year is the number of years between the first and last survey used in calculation

and forest restoration measures urgently need to be reviewed and strengthened by the stakeholders in co-management. There were fewer or less consistent trends in the other sites, with a mix of positive signs and also areas for concern: in Chunati WS canopy species are declining while undergrowth and mid-level species are static, indicating a continued loss of residual larger trees; in Kaptai NP (where co-management was suspended) mid-level species have increased but other strata have been static; in Fashiakhali WS undergrowth species have increased, mid-level species declined and canopy species were static; and in Lawachara NP undergrowth species have increased somewhat but mid-level and canopy species have declined raising questions about the future health of the forest.

Estimated rates of change during the CREL project (a shorter period) tend to be higher and are influenced by appearance and disappearance within this period of some species in some sites. The estimated trends in Table 4.4 also show in some cases recovery of species (and presumably their forest strata) that had declined in the period before 2014. In five of the 14 sites indicator species on average increased in all three forest strata in this period (Dudpukuria-Dhopachari WS, Hazarikhil WS, Fashiakhali WS, Lawachara NP and Rema-Kalenga WS) suggesting both recovery of understory and effective protection of taller trees during this period. No sites experienced declines in indicator birds for all three forest strata in this period, but trends were worst in Himchari NP where mid-level and canopy species declined and only undergrowth species increased. Four sites (Chunati WS, Kaptai NP, Inani reserve forest, and Teknaf WS) showed similar short-term trends of loss of canopy species while undergrowth and mid-level species increased, indicating degradation of overall forest structure but regrowth of shrub layers. Unusually there was a slight decline in undergrowth birds in Khadimnagar NP but also a strong increase in mid-level and canopy species (and over the longer period undergrowth species increased strongly in this site). In Satchari mid-level species have declined unlike other strata, this deserves further investigation. Lastly two sites reveal major imbalances in forest condition. In Medakacchapia NP mid-level species had been lost by the time of and during the CREL surveys – forest here comprises a canopy of Garjan trees and recovering undergrowth. In Modhupur NP canopy species had been lost throughout the CREL period – large trees had all been felled earlier and despite co-management the forest appears limited to undergrowth and secondary growth.

Table 4.4 Percentage change per annum in population densities of indicator species, averaged across species according to main forest strata they use for four years of CREL project.

Protected Area	Undergrowth/ ground	Mid-level	Canopy
Chunati	74.2	49.1	-25.0
Kaptai	11.5	15.0	-0.9
Dudpukuria	18.0	1.6	10.0
Hazarikhil	50.9	23.4	21.8
Fasiakhali	41.5	22.3	37.5
Medakacchapia	18.0	lost	-15.6
Himchari	14.8	-11.4	-25.0
Inani	36.1	1.4	-25.0
Teknaf	27.4	6.0	-25.0
Lawachara	14.8	4.7	73.9
Satchari	7.9	-10.4	38.3
Rema-Kalenga	9.3	25.1	35.8
Khadimnagar	-1.9	83.6	53.8
Modhupur	25.7	25.6	lost

Percentage change in population densities per annum calculated as 2018 density divided by average of 2014-2015 density divided by four (years) times 100

4.2 Species Diversity

Although the focus of the surveys was to quantify population densities of the selected indicator bird species, all species recorded on transects were also noted, and Annex 3 summarizes the consolidated species lists for each site showing the years in which each species was recorded. Hence the bird species diversity during March to August in these four years of surveys can also be calculated (Table 4.5), ranging from the highest diversities in the two sites in the Chittagong Hilltracts (Dudhpukuria-Dhopachari NP and Kaptai NP) to the lowest diversities in Khadimnagar NP and Medakacchapia NP. However, many of the species recorded are generalists that make use of fields, wetlands and bushy areas. Table 4.5 also shows the total species recorded that are typical of forests, and that are exclusively dependent on forest. This confirms through forest bird diversity the ecological quality of

forest in Dudhpukuria-Dhopachari NP and Kaptai NP; but also in three sites in the northeast (Lawachara NP, Rema-Kalenga WS and Satchari NP) and in Hazarikhil WS in Chittagong region.

Table 4.5 Bird species diversity recorded during surveys 2014-2018

Site	Number of species			Rank		
	All species	Forest species	Forest dependent species	All species	Forest species	Forest dependent species
Lawachara NP	79	63	44	13	7	5
Satchari NP	95	76	53	11	3	3
Rema Kalenga WS	100	64	43	8	6	6
Khadimnagar NP	71	43	30	14	13	10
Modhupur NP	99	46	21	9	11	13
Baroiadhala NP	111	65	37	5	5	7
Dudhpukuria-Dhopachari NP	129	82	56	1	2	2
Kaptai NP	128	85	63	2	1	1
Hazarikhil WS	118	72	51	3	4	4
Chunati WS	114	58	32	4	8	9
Medakacchapia NP	62	27	12	15	15	15
Fashikhali WS	92	40	20	12	14	14
Himchari NP	96	46	28	10	11	11
Inani WS	101	56	32	7	9	8
Teknaf WS	103	49	27	6	10	12

Source: species lists in Annex 3

"Forest species" = species that are typical of forest, but including some species that are also typical of village groves and other habitats

"Forest dependent species" = species that are only normally found in forest and depend on this habitat (a subset of "forest species")

4.2 Threats

Loss of habitat through illegal felling, collection of firewood and conversion of mature forest to monoculture are the primary threats to forest resident birds. Additional threats, particularly for terrestrial and undergrowth species, include cutting of bamboo and undergrowth, and in the case of Red Junglefowl hunting and trapping. Broadly, these threats were identified earlier and remain relevant for all 15 PAs in 2018. However, on a positive note there has not been deliberate conversion of forest to monocultures within these PAs since 2013. It is important to note that illegal tree fellers are targeting many fruiting trees including Chapalish (*Artocarpus chaplasha)* and this poses a huge threat to frugivorous birds and mammals. Also, the data are consistent with past loss (Modhupur NP) and continued loss of large trees in several sites particularly in the southeast (Cox's Bazar and to some extent Chittagong regions). These are losses that will take decades to reverse through regrowth of mature large trees.

4.3 Recommendations

Although some key native fruiting trees have been identified and recommended as part of planting and regeneration of forest, it would be useful to prepare a list of native fruiting and flowering plants and trees for each of the PAs and their habitat types, and review this against their use by birds, primates and other wildlife, and then to organize targeted replanting/restoration of these trees in these PAs. This could be localized in PAs that largely have tree cover, but should be larger-scale as part of assisted natural regeneration and forest restoration in PAs that have extensive denuded areas, and should be extended into other degraded forest lands bordering the protected areas (their buffer areas).

It appears that three or ideally four counts along each transect is sufficient to give reasonable annual population estimates, this considerably reduces the task for volunteers whether from the bird club or

from the local community. Further monitoring should be conducted in the early period of the breeding season once each month, ideally between March and June, as song and bird activity reduces during later months and surveys are interrupted by rain, also some areas and transects become inaccessible from June onward with the onset of the monsoon.

Involving local community members in bird monitoring is a positive approach for birds and their habitat conservation. In 2014 CREL-Bbc provided an indicator bird identification guidebook and CD with bird-calls to all local surveyors and this continued in subsequent years. These can assist the local people to carry out the surveys on their own without or with limited support from Bbc volunteers. However, to make it sustainable, the local volunteers need further motivation to form their own bird watching group and carry out surveys on their own with limited resources, and to get some support each year from more experienced bird surveyors. Moreover, this needs support for data analysis and in how to share back findings with the Co-Management Committees and Forest Department personnel. Involving local monitors with local university and school students for joint field trips, where the local volunteers show their area and the birds, will create further attachment to monitoring.

If further training takes place then separate sessions focused on birds and their importance for the forest (and also for wetlands ecosystems in wetland sites) should also be designed to keep them interested and involved. Two potential ways of strengthening this are: a) focusing on eco-guides so that they enhance their skills so that they can show birds to PA visitors and can also conduct transects as part of their time in the forest; b) developing regular links between Bbc and local nature clubs or CMCs directly.

While birds appear to be effective indicator species for the different forest strata, and the data series should be continued to determine longer term trends and to track fluctuations between years which may indicate local problems in forest conservation. There is scope for no additional effort or cost to monitor primate numbers along the same transects (since primates tend to be visible and vocal like birds) which could help guide habitat management since in several sites these are flagship species for the protected area and/or species that attract interest of visitors and potential funders of co-management and conservation.

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ANNEX 1 LOCAL ASSISTANTS ORIENTED IN FOREST BIRD MONITORING AND THEIR SKILLS

Name	Year involved	Age	Institution	Cell	Performance				
					Leadership	Skill	Interests	Punctuality	Commun-ication
Fashiakhali WS									
Nurul Huda Manik	2014-2018	35	CPG President & Eco-guide	01814324136	High	Medium	High	High	High
Md. Mokhlesur Rahman	2018	40	Forest Guard, FD	-	Medium	Medium	Medium	Medium	Medium
Nurul Amin	2016 & 2018	24	Eco-guide	-	High	Medium	High	High	High
Rahim Uddin	2014-2017	30	Freelance	01811858617	High	High	High	High	High
Medakacchapia NP									
Hamidul Islam	2018	30	Eco-guide	01819595952	Medium	Medium	Medium	Medium	Medium
Md. Nurul Afsar	2014-2015	32	Freelance	01811804142	Medium	Medium	High	High	Medium
Md. Ali Akbar	2016 & 2018	40	CPG President	01718782175	Medium	Medium	Medium	Medium	Medium
Moktul Hossain	2014-2018	43	CPG Member	-	Medium	Medium	Medium	Medium	Medium
Sayed Abu Zakaria	2015-2018	45	Range Officer, FD	01820317846	Medium	Medium	High	High	Medium
Himchari NP									
Md. Rafiqul Islam	2014-2018	27	Eco-guide	01837012214	Medium	High	High	High	High
Abdul Latif	2014-2018	38	CPG Member	01823006403	Medium	High	High	High	High
Diman Mandal	2014-2018	28	Forest Guard, FD	01753689753	Medium	Medium	High	High	High
Md. Mofidul Islam	2014-2015	27	Eco-guide	01819821684	High	High	High	High	High
Inani NP (Proposed)									
Md. Amin Ullah (Sona Mia)	2014-2018	35	CPG Member & Eco-guide	01828408449	High	High	High	High	High
Md. Umar Faruq	2018	30	Forest Guard, FD	01930812829	High	Medium	Medium	Medium	Medium
Teknaf WS									
Mony Shapan Chakma	2014-2018	35	Eco-guide	01827499605	High	High	High	High	High
Soila Chakma	2018	33	Eco-guide		Medium	Medium	Medium	Medium	Medium
Jahed Alam	2018	36	CPG member	01874171853	Medium	Medium	Medium	Medium	Medium
Laposha Chakma	2018	30	Freelance	01840548147	Medium	Medium	Medium	Medium	Medium
Md. Idris Ali	2014-2016	25	Freelance	01829355671	High	High	High	High	High
Md. Saiful Islam	2014-2016	25	Freelance	01811111468	High	High	High	High	High
Chunati WS									
Md. Munsur Alam	2018	35	CPG	01814182424	High	Medium	High	High	Medium
Md. Forkan Mia	2018	28	Forest Guard, FD	01813342251	Medium	High	High	High	Medium
Md. Ziaul Haque	2014-2016	21	Freelance	01834731667	High	Medium	High	High	Medium
Md. Sadik	2014-2016	21	Freelance	01838709470	Medium	High	High	High	Medium
Quazi Abdul Qader	2016	50	Forest Guard, FD	01966267377	Medium	High	High	High	Medium
Md. Moazzem	2016-2018	25	Youth Club	01818918254	High	High	High	High	High
Hazarikhil WS									
Md. Shahidul	2018	45	Forest Guard,	01821446795	High	High	High	Medium	Medium

Name	Year involved	Age	Institution	Cell	Performance				
					Leadership	Skill	Interests	Punctuality	Commun-ication
Islam			FD						
Md. Sahabuddin Mannan	2014-2018	41	Guide	01815382431	High	High	High	High	High
Shahadat Hossain Mia	2016	40	Forest Guard, FD	0181646649	Medium	Medium	Medium	Medium	Medium
Shunil De	2014-2015	40	Freelance	01826533430	Medium	Medium	Medium	Medium	Medium
Noni Sharma	2014-2018	41	Freelance	01812800380	Low	Medium	Medium	Medium	Medium
Kaptai NP									
Uttom Kumar Borua	2015-2018		Forest Guard, FD	01857209677	Medium	Medium	Medium	Medium	Medium
Huichai Marba	2015-2018		Eco-guide	01874463037	Medium	Medium	Medium	Medium	Medium
Onkhio Jai Marma	2016		Forest Guard, FD	01840109455	Medium	Medium	Medium	Medium	Medium
Md. Nazim Uddin	2014-2015	22	Freelance	01828435821	High	High	High	High	High
Md. Kamrujjaman	2014-2015	35	Forest Guard, FD	01828804475	Medium	Medium	Medium	Medium	Medium
Sazzad Hossain Nizam	2014	20	Freelance	01850565710	High	High	High	High	High
Baroiardhala NP									
Kamrul Haque	2018	25	Eco-guide	01845782193	Medium	Medium	Medium	Medium	Medium
Lokman Gani	2018	26	CPG member	01830092664	Medium	Medium	Medium	Medium	Medium
Md. Shahidul Hasan	2018	36	Forest Guard, FD	01724317437	Medium	Medium	Medium	Medium	Medium
Asim Barai	2016	30	Beat Officer, FD	01838801886	High	High	High	High	High
Alamgir Hossain	2016	26	CPG member	01830092664	Medium	Medium	Medium	Medium	Medium
Md. Asaduzzaman	2015	35	Forest Guard, FD	01818189626	High	High	High	High	High
Md. Mamun	2015	25	Eco-guide	-	High	High	High	High	High
DDWS- Dudpukuria									
Md. Mintu	2018	40	Beat Officer, FD		High	High	High	High	High
Md. Abu Zafar	2014-2015	65	CPG	-	Medium	Medium	Medium	Medium	Medium
Md. Khorsed Alom	2014-2015	28	Eco-guide	01819365602	Medium	Medium	Medium	Medium	Medium
Md. Babul Khan	2014-2015	35	Eco-guide	01834468904	Medium	Medium	Medium	Medium	Medium
Md. Abdur Rajjak	2018	26	CPG	01821971418	Medium	High	Medium	Medium	Medium
Md. Motiur Rahman	2016	45	?	01819181532	Medium	Medium	Medium	Medium	Medium
DDWS- Dhopachari									
Md. Mahabub Alam	2014-2018	45	CPG+ Guide	01850889286	High	High	High	High	High
Md. Touhidul Islam Taher	2014-2015	18	Guide	01832712019	Medium	Medium	Medium	Medium	Medium
Md. Ibrahim	2014-2018	35	CREL	01828576884	Medium	Medium	Medium	Medium	Medium
Md. Abdus Salam	2014-2018	45	CPG	01637075386	Medium	Medium	Medium	Medium	Medium
Forkan Ahmed	2014-2016	42	Freelance	01821455337	Medium	Medium	Medium	Medium	Medium
Khadimnagar NP									
Suel Das	2014-2018	21	Eco Tour Guide (new)	01768137203	Newly Joined	Medium	High	High	High
Mr. Shipon Goala	2014-2018	27	Forest Guard, FD	01733607750	Low	Medium	High	Medium	High
Mr. Bilash	2014-2016	27	Eco Tour	01728968279	High	High	High	High	High

Name	Year involved	Age	Institution	Cell	Performance				
					Leadership	Skill	Interests	Punctuality	Commun-ication
Banarjee			Guide						
Lawachara NP									
Mr. Santosh Kol	2014-2018	40	Eco Tour Guide	01199366121	Medium	Medium	High	High	High
Mr. Syamol Devbarma	2014-2018	36	Eco Tour Guide	01727298921	High	High	High	High	High
Satchari NP									
Prosenjit Deb Barman	2014-2018	22	Eco Tour Guide SNP	01749015466	High	High	High	High	High
Harish Deb Barma	2014-2018	28	Freelance Eco Tour Guide	01843546327	High	High	High	High	High
Rasel Deb Barma	2014-2018	25	Freelance	01190751879	High	High	High	Medium	High
Rema-Kalenga WS									
Monirul Islam Sujon	2014-2018	27	Freelance	01719190436	High	Medium	High	High	High
Abdur Rahim	2014-2018	34	Freelance	01741144174	High	High	High	Medium	High
Tajul Islam Shopon	2014-2018	36	Freelance	017156914460	Medium	Medium	High	Medium	High
Modhupur NP									
Md. Abul Kalam Azad	2014-2018	27	Eco-guide (Freelance)	01740550356	High	High	High	High	High
Lojesh Mree	2014-2018	28	Eco-guide (Freelance)	01780581763	High	High	High	High	High
Md. Julhash Mia	2014-2016	47	Forest Guard, FD	01710696557	High	Medium	High	Medium	High

ANNEX 2:

DATA SHEET FOR RESIDENT INDICATOR BIRD SURVEY

Climate-Resilient Ecosystems and Livelihoods (CREL) Project
Participatory Forest Resident Bird Survey
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	**Oriental Pied Hornbill ( )**			
2	Crested Serpent Eagle ( )			
3	**Scarlet Minivet ( )**			
4	**Greater Racket-tailed Drongo** (বড় র‍্যাকেটফিঙ্গে)			
5	**Hill Myna ( )**			
6	Crimson Sunbird (সিঁদুরে মৌটুসি)			
7	**Green-billed Malkoha ( )**			
8	**White-rumped Shama ( )**			
9	Red-headed Trogon)			
10	White-crested Laughingthrush ( )			
11	Abbott's Babbler ( )			
12	**Puff-throated Babbler ( )**			
13	**Red Junglefowl ( )**			

NB. Species in Bold font are common to all PAs.

ANNEX 3. LIST OF ALL BIRD SPECIES RECORDED IN FOUR YEARS (2014, 2015, 2016, 2018) IN 15 PROTECTED AREAS DURING FOREST BIRD MONITORING SURVEYS

Note: 4 = recorded in 2014, 5 = recorded in 2015, 6 = recorded in 2016, 8 = recorded in 2018
Normal font = recorded in 1 or 2 survey months in that year, **bold yellow** = recorded in 3 or 4 survey months in that year

Sl	English Name	*Genus*	*Species*	Th	St.	Ha	R	Lawa-chara NP	Satchari NP	Rema Kalenga WS	Khadimnagar NP	Modhupur NP	Baroiadhala NP	Dudhpukuria-Dhopachari NP	Kaptai Np	Hazarikhil WS	Chunati WS	Medakacchapia NP	Fashikhali WS	Himchari NP	Inani WS	Teknaf WS
1.	White-cheeked Partridge	*Arborophila*	*atrogularis*	NT	r	Fe	**R**		4 5 **6 8**	4 5 **6 8**				5	4 6	6 8						
2.	Red Junglefowl	*Gallus*	*gallus*		r	F		4 5 **6 8**	**4** 5 **6 8**	**4** 5 **6 8**	**4** 6 8	**4** 5 **8**	5 **6 8**	5 6 **8**	4 5 6 **8**	4 5 **6 8**	5 **6 8**	8	5 8	5 8	5 8	5 8
3.	Kalij Pheasant	*Lophura*	*leucomelanos*		r	Fe		4 5 8	4 6 8	5 8			6 8	6	5 6	6 8						
4.	Grey Peacock Pheasant	*Polyplecpron*	*bicalcaratum*		r	F	**R**									8						
5.	Lesser Whistling Duck	*Dendrocygna*	*javanica*		W/r	W		8	8	6 8		6	6 8	5 6	8		6 8		4 8	4 5	6	5
6.	Rock (Feral) Pigeon	*Columba*	*livia*		R	V						4 5 6				8	8			5	5	5
7.	Oriental Turtle-Dove	*Streptopelia*	*orientalis*		r	Fe			8	5 6 8			8			6 8	8				4 6	
8.	Eurasian Collared Dove	*Streptopelia*	*decaocto*		R	V			6			4 6 8	8		5	5		5	5 6 8	5	5	5 6
9.	Red Turtle-Dove	*Streptopelia*	*tranquebarica*		R	V				8		5 6 8	5	4		4 6	4 5	5 6 8	5 8		4	
10.	Western Spotted Dove	*Spilopelia*	*suratensis*		R	V		5 8	**4 5 6** 8	**4 6 8**	4 6	**4 5 6** 8	**6 8**	**4** 5 6 8	**4 6** 8	**4** 5 **6** 8	4 5 **6 8**	4 5 6 **8**	**4** 5 **6 8**	**4 6** 8	**4 6** 8	**6 8**
11.	Grey-capped Emerald Dove	*Chalcophaps*	*indica*		R	F		4 **6**	4 5 6 8	6 **8**	4 6	4 5 **6**		4 6 8	5 6	4 6	4			6	6	6
12.	Orange-breasted Green Pigeon	*Treron*	*bicinctus*		r	Fe			8					5		6						
13.	Pin-tailed Green Pigeon	*Treron*	*apicauda*		r	Fe									4 6							
14.	Ashy-headed Green Pigeon	*Treron*	*affinis*		r	Fe			4	**4** 8				5	6 8	4 6 8					4 5	5
15.	Thick-billed Green Pigeon	*Treron*	*curvirostra*		r	Fe		8		8											4 5 8	
16.	Yellow-footed Green Pigeon	*Treron*	*phoenicopterus*		R	F		5 **6** 8	8	5 6 **8**		**5** 8	5 6 8	5	**4** 6	6	8		6 8		5	
17.	Green Imperial Pigeon	*Ducula*	*aenea*		r	Fe		6			4				**4** 5 **6 8**							
18.	Large-tailed Nightjar	*Caprimulgus*	*jotaka*		r	F	**R**						6 8	6								

Sl	English Name	*Genus*	*Species*	Th	St.	Ha	R	Lawa-chara NP	Satchari NP	Rema Kalenga WS	Khadimnagar NP	Modhupur NP	Baroiadhala NP	Dudhpukuria-Dhopachari NP	Kaptai Np	Hazarikhil WS	Chunati WS	Medakacchapia NP	Fashikhali WS	Himchari NP	Inani WS	Teknaf WS
19.	Asian Palm-Swift	*Cypsiurus*	*balasiensis*		R	V				4 **6**	5	4 5 **6**	6 **8**	4 6	**4**	4 5 6	4 5 6 8	5	5 **6** 8	5 6 8	5 6	5 **6** 8
20.	Greater Coucal	*Centropus*	*sinensis*		R	V		5 6 8	6	**4 5 6 8**	**5 6** 8	4 **5 6** 8	8	4 5 6 8	4 6 8	4 **5 6** 8	4 5 6	**4** 5 6 8	**4** 5 6 8	**4** 5 6 **8**	**4** 5 6	**4** 5 6 8
21.	Lesser Coucal	*Centropus*	*bengalensis*		R	B				4			8	4 6	**4** 6 8	4 6	4	**4**	**4** 5	**4** 5 6 8	**4** 5 6 **8**	**4 5 6**
22.	Green-billed Malkoha	*Phaenicophaeus*	*tristis*		R	F		4 **5** 6	4 5 **6**	4 5 **6** 8	**6** 8	**4** 5	**5 6** 8	**4 5 6**	**4 5 6 8**	5 6	4 5 6 **8**	4		**4**	**4** 5 6	4 6 8
23.	Jacobin (Pied) Cuckoo	*Clamator*	*jacobinus*		S	V						5					6					5
24.	Asian Koel	*Eudynamys*	*scolopacea*		R	V				4 6		4 5 6	6	4 6	4 6	4	4	5	5	5	5	5
25.	Banded Bay Cuckoo	*Cacomantis*	*sonneratii*		r	Fe	**R**	5	5 6													
26.	Plaintive Cuckoo	*Cacomantis*	*merulinus*		R	V						6	5					5 6	4 5 6 8	5 8	5	5
27.	Square-tailed Drongo-Cuckoo	*Surniculus*	*lugubris*		R	Fe		**5** 6 8	**5 6 8**	6 8	6		5	4 6	4 5 6	4 6					4	
28.	Common Hawk Cuckoo	*Hierococcyx*	*varius*		R	V		8	6	8		4 5 **6** 8	8	4	4	4 6	5					
29.	Indian Cuckoo	*Cuculus*	*micropterus*		R	V		6 8	5 **6 8**	5 **6** 8	5 6	4 5 **6** 8	5 **6** 8	4 5 **6** 8	5 6	6 8	**5 6 8**	5 8	4 5 **6** 8	5	5 6	5 8
30.	Ruddy-breasted Crake	*Zapornia*	*fusca*		r	W											5			6		
31.	White-breasted Waterhen	*Amaurornis*	*phoenicurus*		r	W						5		6		8	6 8		5	**4** 6		5 6 8
32.	Cinnamon Bittern	*Ixobrychus*	*cinnamomeus*		R	Wp				4	4					6				5	6	8
33.	Malayan Night Heron	*Gorsachius*	*melanolophus*		r	Fe	**R**								5 6 8							
34.	Indian Pond Heron	*Ardeola*	*grayii*		R	W				**5 6 8**		4 5 6 8	5 6 **8**	5 6	5	**6** 8	**5 6 8**	4 5 6 8	**4 5 6** 8	4 5	**4** 5 6 8	4 **5** 6 8
35.	Chinese Pond Heron	*Ardeola*	*bacchus*		v	W	**R**			6												
36.	Cattle Egret	*Bubulcus*	*ibis*		R	W		8	5	6 8		5	5 6 8	8	6 8	5 6	6 8					5 6 8
37.	Grey Heron	*Ardea*	*cinerea*		Wr	W											6	5	5			
38.	Little Egret	*Egretta*	*garzetta*		R	W				4 8			6	5	6	8	5 6	8		5	5 8	5
39.	Little Cormorant	*Microcarbo*	*niger*		R	W						4	6 8			6	5 6 **8**		5 8	5	5	5
40.	Yellow-wattled Lapwing	*Vanellus*	*malarbaricus*		r	WV	**R**					5 6 8										
41.	Red-wattled Lapwing	*Vanellus*	*indicus*		R	W				**6** 8	5	4 5 6		6		4 **6** 8	**4** 6 8					5
42.	Barred Buttonquail	*Turnix*	*suscitator*		r	Fe										6			4	4 5 8		8
43.	Asian Barred Owlet	*Glaucidium*	*cuculoides*		R	Fe		5 **6 8**	5 **6** 8	4 5 **6 8**			5 6	**5 6 8**	4 6 8	6 8		4	5		6 8	4 6

Sl	English Name	*Genus*	*Species*	Th	St.	Ha	R	Lawa-chara NP	Satchari NP	Rema Kalenga WS	Khadimnagar NP	Modhupur NP	Baroiadhala NP	Dudhpukuria-Dhopachari NP	Kaptai Np	Hazarikhil WS	Chunati WS	Medakacchapia NP	Fashikhali WS	Himchari NP	Inani WS	Teknaf WS
44.	Mountain Scops Owl	*Otus*	*spilocephalus*		R	Re	**R**									**4** 6 8						
45.	Spot-bellied Eagle Owl	*Bubo*	*nipalensis*		R	Fe										4 8						
46.	Osprey	*Pandion*	*haliaetus*		w	W					5	6										
47.	Oriental Honey-buzzard	*Pernis*	*ptilorhynchus*		r	F		8		6 8		4 5 8	5 8	6 8		6 8	8	8	4 8			
48.	Jerdon's Baza	*Aviceda*	*jerdoni*		r	Fe									6							
49.	Black Baza	*Aviceda*	*leuphotes*		w	Fe				4 5 6 8				5	4 6							
50.	Crested Serpent Eagle	*Spilornis*	*cheela*		R	FV		5 6 8	4 5	6 8	4 6	4 5 **8**	6 **8**	**4** 5 6 8	6 8	4 6 8	8	**4**	**4** 8	4 6	4 5 8	4
51.	Changeable Hawk Eagle	*Nisaetus*	*cirrhatus*		r	F						4 5 6			8							
52.	Shikra	*Accipiter*	*badius*		R	V		5 8	5	6 **8**	5	5	5 6 8	4 5 6 8	**4** 5 6 8	4 6	4 6		4 5	4	5	
53.	Common Kestrel	*Falco*	*tinnunculus*		w	V						4										
54.	Brahminy Kite	*Haliastur*	*indus*		R	V					5	5	8			6						
55.	Red-headed Trogon	*Harpactes*	*erythrocephalus*		r	Fe		4 **5** 8	4 5	4 5 6 **8**				4 5 6 8	4 6	4 6	4 8					
56.	Oriental Pied Hornbill	*Anthracoceros*	*albirostris*		r	Fe		4 6	4 5 6 **8**	4 5				4 5 6 8	4 **5** 6 8	4 5 6 8						
57.	Common Hoopoe	*Upupa*	*epops*		r	V				8	6	5 6		6					5	5	5	5
58.	Blue-bearded Bee-eater	*Nyctyornis*	*athertoni*		r	Fe		8	5 6 8	6 8	8			6 8	6	8	6			8	6	
59.	Asian Green Bee-eater	*Merops*	*orientalis*		R	V					4	5	6 8	**4** 5 6	**4** 6 8	4 6	4 5 6 **8**		5 6 8	**6** 8	6 8	5 6 8
60.	Chestnut-headed Bee-eater	*Merops*	*leschenaulti*		r	Fe		4 5	**4** 5 **6 8**	**4** 5 6 8	5 6	5	8	**4** 6 8	**4** 5 6 **8**	4 6 **8**	**4** 5 6 8	5 6	6 8	4 6 **8**	**4** 6	4 5 6 **8**
61.	Blue-tailed Bee-eater	*Merops*	*philippinus*		r	V			6					5	6	6	5 6 8	**4**	**4** 6 8	**4** 6 8	4 5 6 8	**4** 6 8
62.	Indian Roller	*Coracias*	*benghalensis*		R	V						4 5										
63.	Indochinese Roller	*Coracias*	*affinis*		r	V	**R**							**4** 5 6 8	4 **6** 8	4 5 6 8	4 6 8	4 6	5 6 8		4 5 6 8	4 5 **6** 8
64.	(Oriental) Dollarbird	*Eurystomus*	*orientalis*		ps	Fe		8	8					5 6 8	5 6 8		6					
65.	Common Kingfisher	*Alcedo*	*atthis*		R	W				8	6	8		4 6 8	4 6	4 6	**6** 8		8	5 6 8	5 8	5
66.	Blue-eared Kingfisher	*Alcedo*	*meninting*		R	V									**4** 6 8							
67.	Pied Kingfisher	*Ceryle*	*rudis*		R	Wr											4 8			4 6	4 5	

Sl	English Name	*Genus*	*Species*	Th	St.	Ha	R	Lawa-chara NP	Satchari NP	Rema Kalenga WS	Khadimnagar NP	Modhupur NP	Baroiadhala NP	Dudhpukuria-Dhopachari NP	Kaptai Np	Hazarikhil WS	Chunati WS	Medakacchapia NP	Fashikhali WS	Himchari NP	Inani WS	Teknaf WS
68.	Oriental Dwarf Kingfisher	*Ceyx*	*erithaca*		R	Fe									4							
69.	Stork-billed Kingfisher	*Pelargopsis*	*capensis*		R	W				4 5 **6 8**	6	**4** 5 **6**	**8**	4	4	4 5 6 8	**4** 5 6 **8**	**8**	4 5 **8**	8		5 6 8
70.	White-breasted Kingfisher	*Halcyon*	*smyrnensis*		R	V		5 8	**6 8**	4 6 8	4 5 6	**4** 5 **6 8**	6	**4** 5 **6** 8	**4** 6	4 5 6 8	4 5 6 **8**	5 6 **8**	4 5 **6 8**	4 5 **6** 8	4 5 6 8	5 **6 8**
71.	Coppersmith Barbet	*Psilopogon*	*haemacephalus*		R	VFd				6		4 **5** 6	5 8	5 8	4 8		8		4 5 **6 8**	4 5	4 5 6 8	5 8
72.	Blue-eared Barbet	*Psilopogon*	*cyanotis*		r	Fe		6 8	4 5 **8**	5 6 **8**			**4**	**6**	4 6	4						
73.	Lineated Barbet	*Psilopogon*	*lineatus*		R	F		4 5 **6 8**	**4** 5 **6 8**	**4** 5 6 **8**	6	**4** 5 **6 8**	5 **6 8**	4 5 **6 8**	**4** 5 6 8	4 5 **6 8**	8				8	8
74.	Blue-throated Barbet	*Psilopogon*	*asiaticus*		R	Fe		4 5 **6 8**	5 **6 8**	**6** 8	5 **6** 8	4	6 8	4 **6**	4 6	4 6	6				8	8
75.	White-browed Piculet	*Sasia*	*ochracea*		r	Fe					5			4 5	6							
76.	Greater Flameback (Goldenback)	*Chrysocolaptes*	*guttacristatus*		R	F		5 6 8	4 5 6	4 6	6	4 6	6	4 5 6	4 5 6 8	**4** 6	4 6			4	4 5 6 8	5 8
77.	Black-rumped (Lesser) Flameback (Goldenback)	*Dinopium*	*benghalense*		R	V			4	4	4	5 6 8	8		8	4 6		8	4	4 5	5 8	4 5 8
78.	Rufous Woodpecker	*Microptemus*	*brachyurus*		R	Fe		6	4 5 **8**	4 6 8		**4** 5 6 8	5 6 8	6 8	8	**4**5 8	6			8	8	**8**
79.	Greater Yellownape	*Chrysophlegma*	*flavinucha*		R	Fe		4 5 **6** 8	4 5 6 8	**4** 5 **6 8**			8	4 6	**4** 6	**4** 6				4	5	5
80.	Lesser Yellownape	*Picus*	*chlorolophus*		r	Fe		4 5 6	5	4					4							
81.	Great Slaty Woodpecker	*Mulleripicus*	*pulverulentus*		R	Fe	**R**								4 5 **6** 8							
82.	Bay Woodpecker	*Blythipicus*	*pyrrhotis*		R	Fe									4 6							
83.	Grey-capped Pygmy Woodpecker	*Picoides*	*canicapillus*		r	Fd		6	6 8	6 8	5 6 8	5 6				6	8		6	8		
84.	Fulvous-breasted Woodpecker	*Dendrocopos*	*macei*		R	V				4 6	5	4 5 6 8		4 6	4	**4** 8	**4** 6		5 **6**	5	5 8	5
85.	Amur Falcon	*Falco*	*amurensis*		p	V	**R**	6 8	5	5 8	6											
86.	Vernal Hanging Parrot	*Loriculus*	*vernalis*		r	FeB		8	5 6 **8**	8			8						5		5 6	
87.	Blossom-headed Parakeet	*Psittacula*	*roseata*		r	F			5 **6 8**					5							6	
88.	Red-breasted Parakeet	*Psittacula*	*alexandri*		R	FeB		5 6 8	4 6 8	**4** 5 **6 8**		4 5 **6** 8	**6** 8	4 5 **6 8**	4 5 **6 8**	4 5 **6** 8	4 5 6 **8**	4 5 6 **8**	4 5 6 8	4	4 5 **6** 8	5 6 8
89.	Rose-ringed Parakeet	*Psittacula*	*krameri*		R	V					6	**5** 6 8	5 6		5 6		**5** 6	**5** 6 8	5 8		6	5
90.	Blue-naped Pitta	*Pitta*	*nipalensis*		r	Fe	**R**	6	5					8	5 8		5 6 8					5

Sl	English Name	*Genus*	*Species*	Th	St.	Ha	R	Lawa-chara NP	Satchari NP	Rema Kalenga WS	Khadimnagar NP	Modhupur NP	Baroiadhala NP	Dudhpukuria-Dhopachari NP	Kaptai Np	Hazarikhil WS	Chunati WS	Medakacchapia NP	Fashikhali WS	Himchari NP	Inani WS	Teknaf WS
91.	Hooded Pitta	*Pitta*	*sordida*		s	Fe		5 **6** 8	4 5 6 8		5 6		6	4 6	4 6	**4** 5 8	4						
92.	Indian Pitta	*Pitta*	*brachyura*		s	Fd						4 5 6 8											
93.	Silver-breasted Broadbill	*Serilophus*	*lunatus*		R	Fe	**R**									8							
94.	Ashy Woodswallow	*Artamus*	*fuscus*		R	V				5	5	**4 5 6** 8	5 6 8	4 **6**	5 **4** 6	4 5 **6**	4 **6 8**	**4**	**4 6 8**	**4 6 8**	**4 5 6** 8	4 5 6 8
95.	Common Iora	*Aegithina*	*tiphia*		R	FV		4 **5 6 8**	4 **5 6 8**	4 **6** 8	**4** 5 **6** 8	**4 5 6 8**	5 6 **8**	**4 5** 6 8	**4 6** 8	4 **5 6** 8	4 **5** 6 **8**	**4 5** 6 8	**4 5 6 8**	**4** 6	**4 6 8**	4 **5** 8
96.	Common Woodshrike	*Tephrodornis*	*pondicerianus*		R	Fd		8	8	4 8		**4** 5 **6** 8	6				6	**8**	5 6 8		5	
97.	Large Cuckooshrike	*Coracina*	*macei*		R	F		5 6		5 **8**	5	**4** 5 **6** 8	**6** 8	6		**4** 8	**6** 8	8	**6** 8		8	8
98.	Black-winged Cuckooshrike	*Coracina*	*melaschistos*		w	F		8					5 6		6		8					
99.	Rosy Minivet	*Pericrocotus*	*roseus*		w	Fe			6			6				6	5					
100.	Small Minivet	*Pericrocotus*	*cinnamomeus*		r	Fd		8	4 **8**	5 6	5 6	4 **5** 8	8	5 8			6	4 5 6 **8**	4 **5 6** 8	**4** 5 6	**4**	4 8
101.	Swinhoe's Minivet	*Pericrocotus*	*cantonensis*		w	Fe							6	6								
102.	Scarlet Minivet	*Pericrocotus*	*flammeus*		R	Fe		5 **6** 8	5 6 **8**	4 **8**	4 5 6 8	8		4 **5 6** 8	8	4 5 6 8	5		5 **8**			
103.	Long-tailed Shrike	*Lanius*	*schach*		R	V						4 **5 6** 8	6	6		**6**	**6**		6			5
104.	Indian Golden Oriole	*Oriolus*	*kundoo*		r	FV		8	5				6	6								
105.	Black-naped Oriole	*Oriolus*	*chinensis*		r	F	**R**		5 8			6	8	8								
106.	Black-hooded Oriole	*Oriolus*	*xanthornus*		R	V		**5 6**	**4 5 6 8**	**4 5 6 8**		**4 5 6 8**	**5 6 8**	4 5 6 8	**4 5 6** 8	4 6 8	4 **5 6 8**	5 6 8	4 5 6 **8**	4 5	4 5 6 8	5 8
107.	Black Drongo	*Dicrurus*	*macrocercus*		R	V		8	5 6 8	**4** 5 6 8	4 5 **6** 8	**4 5 6** 8	5 6 **8**	4 5 **6** 8	**4** 6 8	4 **5 6** 8	4 5 **6 8**	**4 6 8**	**4 5 6 8**	**4 5 6** 8	**4** 5 6 8	4 5 **6 8**
108.	Bronzed Drongo	*Dicrurus*	*aeneus*		R	F		6 8	**4 5 6 8**	4 6 8	5 **6** 8	**4 5 6 8**	5 **6** 8	4 5 6	**4** 6 8	4 5 6 8	5 6 8	4 8	4 5 **8**	4 5 8	5 6	5 8
109.	Hair-crested Drongo	*Dicrurus*	*hottentotus*		R	F		5 6 8	4 5 8	**4 5 6 8**	4 6 8	**4 5 8**	5 **6 8**	4 6 8	**4 5** 6 **8**	4 6 8	4 5 6 **8**	8				8
110.	Greater Racket-tailed Drongo	*Dicrurus*	*paradiseus*		R	Fe		4 5 **6** 8	4 5 **6 8**	**4 5 6** 8	5 6 8	**8**	5 8 6	**4** 5 6 8	**4 5 6** 8	**4 5 6** 8	6 8	8	4 5 8		4 5 6	5 6 8
111.	White-throated Fantail	*Rhipidura*	*albicollis*		r	V						5		6		6		8	6 8			
112.	Black-naped Monarch	*Hypothymis*	*azurea*		R	F		4 5 6	5 8	4 5 6 **8**	**4 5 6 8**	**4 5 6** 8	6	**4 5** 6	**4 5 6** 8	4 5 **6 8**	4 6	**4**	**4** 5	4	4 5	
113.	Indian Paradise-flycatcher	*Terpsiphone*	*paradisi*		r	F			5		5 6	5 6										
114.	Oriental Paradise-flycatcher	*Terpsiphone*	*affinis*		r	Fe	**R**									6			5			

Sl	English Name	*Genus*	*Species*	Th	St.	Ha	R	Lawa-chara NP	Satchari NP	Rema Kalenga WS	Khadimnagar NP	Modhupur NP	Baroiadhala NP	Dudhpukuria-Dhopachari NP	Kaptai Np	Hazarikhil WS	Chunati WS	Medakacchapia NP	Fashikhali WS	Himchari NP	Inani WS	Teknaf WS
115.	(Common) Green Magpie	*Cissa*	*chinensis*		r	Fe			6 8				5 6 8	5	5 6 **8**	5 6 8	8				6	6
116.	Rufous Treepie	*Dendrocitta*	*vagabunda*		R	VFd				**4** 6 8		**4 5 6 8**	5 **6 8**	4 5 6	**4** 6	4 5 6	4 5 **6 8**	4 5	4 5 6 8	**4** 5	**4** 5 **6** 8	**4** 5 6 8
117.	Grey Treepie	*Dendrocitta*	*formosae*		R	Fe		6	5 6 8	8			6	4		4 6 8	4		4	5 6		
118.	House Crow	*Corvus*	*splendens*		R	V				8		5	6 8	**4** 6 8	**4** 6	4 6	**4 5** 6 8	5	5 6 **8**	5	5	5
119.	Jungle (Large-billed) Crow	*Corvus*	*macrorhynchos*		R	V		5 6 **8**	5 6 **8**	6 8	4 6 8	4 **5** 6	5 **6 8**	4 **6** 8	**4** 6 8	**4** 6 8	4 5 6 8	4 6	6 8	**4**	4 6 8	8
120.	Great Tit	*Parus*	*major*		r	Fd					6	4 8	6	4 6 8	4 5	4	4 6		5 6 8	5 6 8	5 8	5
121.	Sand Martin	*Riparia*	*riparia*		w	Wr								6					5 6	5	5	
122.	Plain (Brown-throated) Martin	*Riparia*	*paludicola*		R	Wr											5 6					
123.	Barn Swallow	*Hirundo*	*rustica*		Wr	V				4		6	6		6		5		5	5	5	5
124.	Bengal Bushlark	*Mirafra*	*assamica*		R	V						4 8										
125.	Rufescent Prinia	*Prinia*	*rufescens*		r	GB							5 6						8			5
126.	Grey-breasted Prinia	*Prinia*	*hodgsonii*		R	B							6	4	4	4 5	8	4 5	**4** 5	4 6	4 6	6 8
127.	Black-headed Bulbul	*Pycnonotus*	*atriceps*		R	Fe			5 6 8	6				8	5 6 8							
128.	Black-crested Bulbul	*Pycnonotus*	*melanicterus*		R	F		**4** 5 **6 8**	4 5 **6 8**	4 5 **6 8**	4 6		6 8	**4 5 6 8**	**4** 5 **6** 8	5 6 8	6			4 6	4 5 6	6
129.	Red-whiskered Bulbul	*Pycnonotus*	*jocosus*		R	FB		**4 5 6 8**	**4 5 6 8**	**4 5 6 8**	**4 5 6 8**	4 5 6 8	**5 6 8**	**4 6 8**	4 5 6 8	**4 5 6 8**	5 6 8	4 6 **8**	**4 6 8**	**4 5 6 8**	4 5 6 8	4 **5 6 8**
130.	Red-vented Bulbul	*Pycnonotus*	*cafer*		R	VB		4 **5** 6	**4 5 6 8**	**4 5 6 8**	4 5 6	**4 5 6 8**	**5 6 8**	**4 5 6 8**	**4 5 6** 8	**4 5 6** 8	**4 5 6 8**	4 5 6 8	**4 5 6 8**	**4 5 6 8**	**4 5 6 8**	4 5 6 8
131.	Olive Bulbul	*Iole*	*virescens*		r	Fe			4 6 8	4 8				**4 5 6** 8	5 **6**	5 8						
132.	White-throated Bulbul	*Alophoixus*	*flaveolus*		R	Fe		**5 6** 8	**5 6 8**	**5 6** 8			6 8	**5 6** 8	4 **5 6** 8	5 6 8				6	4 6	
133.	Common Tailorbird	*Orthotomus*	*sutorius*		R	VB		5 6 8	4 5 6 8	**4** 5 6 **8**	**4 5 6** 8	4 **5 6 8**	5 6 **8**	**4 5** 6 8	**4** 5 6 8	**4** 5 6 8	**4 5 6 8**	**4 5 8**	**4** 6 8	**4** 6 8	**4** 5 6 8	**4** 5 6 8
134.	Dark-necked Tailorbird	*Orthotomus*	*atrogularis*		R	Fe		4 **5 6 8**	4 5 8	5 6 8	6	4		4 6 **8**	4 5 6 8	**4** 6 8	4	4 6 8	4 5 6 8	**4** 5 8	**4** 5 6 8	4 5 6 8
135.	Striated Grassbird	*Megalurus*	*palustris*		R	W								6			**5 6 8**		4 5 8	4 5 6	6 8	6 8
136.	Dusky Warbler	*Phylloscopus*	*fuscatus*		W	B	**R**								6					5		5
137.	Inornate (Yellow-browed) Warbler	*Phylloscopus*	*inornatus*		W	F			8				6	6	6		6			5	5	5 8
138.	Greenish Warbler	*Phylloscopus*	*trochiloides*		W	F		8	6 8				6 8	6			6 8		8		8	5

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139.	Yellow-bellied Warbler	*Abroscopus*	*superciliaris*		r	Fe			5 6		5											
140.	Puff-throated Babbler	*Pellorneum*	*ruficeps*		R	F		4 5 6 8	4 5 6 8	4 5 6 8	4 5 6 8	4 5 8	5 6 8	4 5 6 8	4 5 6 8	4 5 6 8	4 5 6 8	4 5 6 8	4 5 8	4 5 6 8	4 5 6 8	4 5 6 8
141.	Abbott's Babbler	*Malacocincla*	*abbotti*		R	Fe		4 5 6 8	4 5 6 8	4 5 6 8	4 5 6 8	4 5 6 8	5 6 8	4 5 6 8	4 5 6 8	4 5 6 8	4 5 6 8	4 5 6 8	4 5 6 8	4 5 6 8	4 6 8	4 6 8
142.	Large Scimitar Babbler	*Pomatorhinus*	*hypoleucos*		r	Fe								6	8		4			4		
143.	White-browed Scimitar Babbler	*Pomatorhinus*	*schisticeps*		r	Fe			5		4 5 6		6	5	4 5	4 5 6				4 5 6 8	6	
144.	Rufous-fronted Babbler	*Cyanoderma*	*rufifrons*		R	Fe							8	4	4	4						
145.	Grey-throated Babbler	*Stachyris*	*nigriceps*		r	Fe							6 8	4 6	4							
146.	Pin-striped Tit Babbler	*Macronous*	*gularis*		R	Fe		5 6 8	4 5 6 8	5 6 8	4 5 6 8	4 5 6	6 8	4 5 6 8	4 5 6 8	4 5 6 8	6 8	4 5 6 8	4	4 5 6 8	4 5 6 8	4 5 6 8
147.	Chestnut-capped Babbler	*Timalia*	*pileata*		r	BG								6	4			5 8	5 8	4 5 6 8	5 6 8	5 8
148.	Nepal Fulvetta	*Alcippe*	*nipalensis*		R	Fe								4 6 8	4 8							
149.	Striated Babbler	*Turdoides*	*earlei*		R	B			5						4 5		4	4	4 5 8	4 5 6 8	4	4 6
150.	Jungle Babbler	*Turdoides*	*striata*		R	V						4 5 6 8	8?									
151.	White-crested Laughingthrush	*Garrulax*	*leucolophus*		r	Fe									5				5 6 8	4 5		
152.	Lesser Necklaced Laughingthrush	*Garrulax*	*monileger*		r	Fe			5				5 6	4	4 6	4 8	4			4		
153.	Greater Necklaced Laughingthrush	*Garrulax*	*pectoralis*		R	Fe		4 5 6	4 5 6 8	4 5 6 8			5 6 8	5 6	4 5 6 8	4 5 6 8	4 6 8		4 6 8	4	4	4 8
154.	Rufous-necked Laughingthrush	*Garrulax*	*ruficollis*		R	B						4 6	5 8		8	4 6 8	4 5 6 8		4 6 8	4 6 8		6
155.	Orange-headed Thrush	*Geokichla*	*citrin*		R	V						4 5 6 8	6 8				6 8	4		8		
156.	Oriental White-eye	*Zosterops*	*palpebrosus*		R	F		4	4 8	8	4 5 8	4 5 6 8	6 8	4 64	4 6	4 6 8	4 5	4 5 8	4 5 6 8	4 5	4 5	4 5
157.	Asian Fairy Bluebird	*Irena*	*puella*		R	Fe		4 5 6 8	4 5	5				4 6 8	46 8	4						5
158.	Velvet-fronted Nuthatch	*Sitta*	*frontalis*		r	F			6			4 5										
159.	Asian Glossy Starling	*Aplonis*	*panayensis*		r	Fe	R								4		6				5	5
160.	(Common) Hill Myna	*Gracula*	*religiosa*		R	Fe		4 5 6 8	4 5 6 8	4 5 6 8	5 6		5 8	4 5 6 8	4 5 6 8	4 5 6 8	8			4	4 5	4 5
161.	Common Myna	*Acridotheres*	*tristis*		R	V				4 5 6 8	5	4 5 6 8	6 8	4 6	4 6 8	4 5 6 8	4 5 6 8	4 5 6	4 5 6 8	4 5	4 5 6 8	4 5 6 8

Sl	English Name	*Genus*	*Species*	Th	St.	Ha	R	Lawa-chara NP	Satchari NP	Rema Kalenga WS	Khadimnagar NP	Modhupur NP	Baroiadhala NP	Dudhpukuria-Dhopachari NP	Kaptai Np	Hazarikhil WS	Chunati WS	Medakacchapia NP	Fashikhali WS	Himchari NP	Inani WS	Teknaf WS
162.	Jungle Myna	*Acridotheres*	*fuscus*		R	V				4 6	6	**4 5 6 8**	**5 6** 8	**4 5 6**	**4**6	4 **5 6**	4 **5 6 8**	**4** 5 6 8	**4 5 6 8**	**4 5 6** 8	**4 5 6 8**	4 **5 6** 8
163.	Chestnut-tailed Starling	*Sturnus*	*malabaricus*		R	V			6 8		4	4 **5 6** 8	6	4	**4** 6	4 6	4 6	5	4 5 6 **8**	4 5 6	4 5 6 8	4 5 6 8
164.	Asian Pied Starling	*Sturnus*	*contra*		R	V				5	4	**4** 5 6	5 6 **8**	5 **4** 6	5 **4** 6	4 6 8	**4** 5 6 **8**	**4** 5 6 8	**4 5 6 8**	**4** 5 6 8	4 5	4 5 8
165.	Blue Whistling Thrush	*Myophonus*	*caeruleus*		w	F							5 8	6	8	8	8			4		**6 8**
166.	Oriental Magpie-Robin	*Copsychus*	*saularis*		R	V		5 8	5 6 8	4 8	5 8	**4 5 6 8**	5 6 8	**4** 6 8	4 **6** 8	4 **5 6 8**	**4** 5 6 8	**4** 5	**4 6 8**	**4 6 8**	**4** 8	4 6 8
167.	White-rumped Shama	*Copsychus*	*malabaricus*		R	F		**4 5 6 8**	**4 5 6 8**	**4 5 6 8**	4 5 6 **8**	4 5 **8**	5 6 8	**4 5 6** 8	4 **5 6 8**	**4 5** 6 **8**	4 5 6 8				8	
168.	Blue-fronted Redstart	*Phoenicurus*	*frontalis*		v	V							6		6							
169.	Black-backed Forktail	*Enicurus*	*immaculatus*		r	Fe							5 6 8	**4** 6 **8**	**4 5** 6 **8**							5
170.	Pied Bush Chat	*Saxicola*	*caprata*		r	B								5	6			4	6	4 5 6 **8**	6	8
171.	Pale-chinned Blue Flycatcher	*Cyornis*	*poliogenys*		r	Fe		**5 6** 8	5 6 8		5 6 8			6	6	8						
172.	Blue-winged Leafbird	*Chloropsis*	*cochinchinensis*		r	Fe							5	5	5 6	5	6					
173.	Golden-fronted Leafbird	*Chloropsis*	*aurifrons*		R	F		5 6 **8**	4 **5 6 8**	**4 5 6 8**	5	5 6	6	6	6 8	8			6	4	**4** 5 6	5 6
174.	Pale-billed Flowerpecker	*Dicaeum*	*erythrorynchos*		R	VF		5		5 6 8			6 8	6 8		6	5 6 8	4 8	**4 6** 8	**4** 5	**4** 5	5 8
175.	Scarlet-backed Flowerpecker	*Dicaeum*	*cruentatum*		R	Fe		4 5 **6 8**	4 **6** 8	**4 5 6 8**	4 **5 6** 8	6 8	5 6 8	**4 5 6** 8	**4 5 6** 8	**4 5 6** 8	**8**	4 5 8	**4 5 6 8**	4 5 6 8	**4** 5 6 **8**	4 5 6 8
176.	Ruby-cheeked Sunbird	*Anthreptes*	*singalensis*		R	F		5 6 8	8	4 6 8	6 8		6	4 5	4 5 8	6 8	6				5	5 8
177.	Purple-rumped Sunbird*	*Nectarinia*	*zeylonica*		R	V				4 6 8	4	5 **6**	**6** 8	6 8	8	5	6 8		8	5 8		
178.	Purple-throated Sunbird	*Nectarinia*	*sperata*		R	Fe		5 6 **8**	8	5				8	4 5 6 8				8	**4**	**4** 6 8	5 6
179.	Purple Sunbird	*Nectarinia*	*asiatica*		R	VB		6	6			5 6	**6 8**	5 6	5	6	6	4 5	4 5 6	4	4 6	6
180.	Crimson Sunbird	*Aethopyga*	*siparaja*		R	F		5	5 8	8	5 6 **8**	5 8	5 8	5 6 8	**4** 5 6	4 8			8	8	6 8	5 6 8
181.	Little Spiderhunter	*Arachnothera*	*longirostra*		R	Fe		**4** 5 **6 8**	**4 5 6 8**	4 **5 6** 8	4 **5 6** 8		6	**4 5 6** 8	**4 5 6 8**	**4 6**	8			4	4 5 6 8	**5 6 8**
182.	Streaked Spiderhunter	*Arachnothera*	*magna*		R	Fe								4 6		4						
183.	House Sparrow	*Passer*	*domesticus*		R	V						5	6 8	**4** 6	**4** 6	4 6	5 6 8	5	**5 6** 8	5		6
184.	Baya Weaver	*Ploceus*	*philippinus*		R	V						4 5	6 8	4 6	4 6	6	6		5 6 8			
185.	White-throated Munia (Indian Silverbill)	*Lonchura*	*malabarica*		r	V											5		6			

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186.	Chestnut Munia	*Lonchura*	*atricapilla*		R	V											4					
187.	White-rumped Munia	*Lonchura*	*striata*		r	Fe		6 8		8	5 6 8		8	4 6	6		6		8	4 5 6 8	6	5 6 8
188.	Scaly-breasted Munia	*Lonchura*	*punctulata*		R	V						5		6					5 6	6 8		6
189.	Forest Wagtail	*Dendronanthus*	*indicus*		p	F			5 6	6		8										
190.	Yellow Wagtail	*Motacilla*	*flava*		W	VW							5 6 8				6				5	5 6
191.	Olive-backed Pipit	*Anthus*	*hodgsoni*		W	FB			8	8		6	6	6	6	6	6 8			8		
192.	Paddyfield Pipit	*Anthus*	*rufulus*		R	VG						5 6										5

Status	Code
resident	R
winter	W
passage	P
Summer (monsoon)	S