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INTEGRATED PROTECTED AREA CO-MANAGEMENT (IPAC)

**INDICATOR BIRD SURVEY: A COMMUNITY-LED MONITORING FRAMEWORK OF
CO-MANAGED FOREST PROTECTED AREAS IN BANGLADESH.**



May 24, 2012

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Cover Photo:

Indicator birds are resident forest birds identified as proxy indicators set to portray biophysical changes in forest ecosystem with the advent of co-management approach in 10 PA sites. This measure has been incorporated in the design of IPAC under custom indicator 15:- “increase in the density of indicator bird species in wetlands and forested landscapes”. The cover photo is of Scarlet Minivet (*Pericrocotus flammeus*) an indicator species selected for all five forest PAs covered in the study (Khadimnagar NP, Modhupur NP, Kaptai NP, Fasiakhali WS and Medakachapia NP).

INTEGRATED PROTECTED AREA CO-MANAGEMENT (IPAC)

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Prepared by:
Bangladesh bird club (Bbc) &
IPAC's Performance Monitoring Team

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Background

The Integrated Protected Area Co-management (IPAC) Project has been promoting Nishorgo Network – a platform for collaborative management of Protected Areas in 25 forest and wetland PA landscapes including 18 forest PAs of Bangladesh. The Co-management approach was introduced during 2003-04 in five forest PA sites namely Lawachara National Park, Satchari NP, Rema-Kalenga Wildlife Sanctuary, Chunati WS and Teknaf WS under Nishorgo Support Project (2003-2008) with financial support from the USAID. Later this approach scaled-up to other 13 forest PAs in the country through Integrated Protected Area Co-management (IPAC) Project of GOB-USAID. Indicator forest birds' survey has been taken as a proxy indicator to measure bio-physical improvement of forest eco-systems since birds are more visible and responsive to ecological changes in their habitats (Johnston 1956, Morrison 1986, Welsh 1987, Temple and Wiens 1989, Canterbury et al. 2000, Browder 2002). The pilot phase of indicator bird survey was conducted in initial 5 co-managed PAs during 2005-2008. Later in IPAC project another 5 forest PAs viz. Kaptai NP, Fasiakhali WS, Medakachapia NP, Modhupur NP and Khadimnagar NP are included in bird survey during 2009-2010. All of those bird surveys were conducted by Dr Monirul Khan, a professional wildlife biologist supported by his students, using strip transect sampling and complemented by opportunistic recording of other species. To test how bird monitoring could be made more sustainable and incorporate it into CMOs monitoring tool, IPAC took an initiative with Bangladesh bird club (Bbc) to undertake surveys through volunteers from the bird club and to train interested local people (CMMO members) in the same methods, applying this to the same five PAs and transects as covered in 2009 and 2010.. This report highlights the results of this Jun-Dec 2011 indicator bird survey in comparison with expert-led previous (2009-2010) systematic survey of bird population density in 5 PAs.

Conceptual framework

Monitoring ecosystem health of co-managed forest PA sites is prioritized to oversee the impact of paradigm shift in forest management approach in Bangladesh. However, recent progress in REDD+ further emphasized about community based monitoring regime as a sustainable tool for its Monitoring Reporting and Verification (MRV). 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 expected to lead in monitoring the trends of resources and uses. With this view, a community led monitoring protocol of indicator forest bird density has been taken as a tool to monitor improvement or degradation of PA ecosystems.

Based on the nature of forests e.g. tropical mixed ever-green and 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 - 14 indicator species in total, with 10 species for each PA site - by bird experts (Table1). Forty (40) transects were monitored and survey design are defined and being implemented in 5 PA sites (Annex 1).

The strip transect sampling method is a combination of quadrat sampling and line transect sampling where objects are counted from straight, long and narrow strips. This is suitable for population estimation of visible and mobile organisms and does not require much of expert knowledge. Further the opportunistic survey method is suitable for recording the species diversity, composition and other important information, whenever available, without following any systematic approach.

Table 1: Indicator resident forest-birds

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

Results and discussion

This approach of indicator bird density assessment has been conducted with two different team compositions namely, i. expert-led assessment whereby Dr. Monirul H. Khan, Jahangirnagar University and local people participated (2009-2010), ii. volunteers from Bbc and trained community birders (June-Dec 2011). In all the cases bird density (individuals/sq km) were calculated for comparison and trend analysis.

Context - NSP bird surveys 2005-2008

Indicator bird survey conducted in 5 pilot PA sites namely Lawachara NP, Satchari NP, Rema-Kalenga WS, Chunati WS and Teknaf WS during Feb-Aug of 2005-2008 by renowned bird expert Dr. Monirul H. Khan, Jahangirnagar University, Bangladesh, his students and local community members also took part in these surveys. The results of these survey (fig-1 and table-2) shows increase of two birds viz. Red Junglefowl and Puff-throated Babbler however, the population densities of remaining birds remained more or less unchanged over 2005-08.

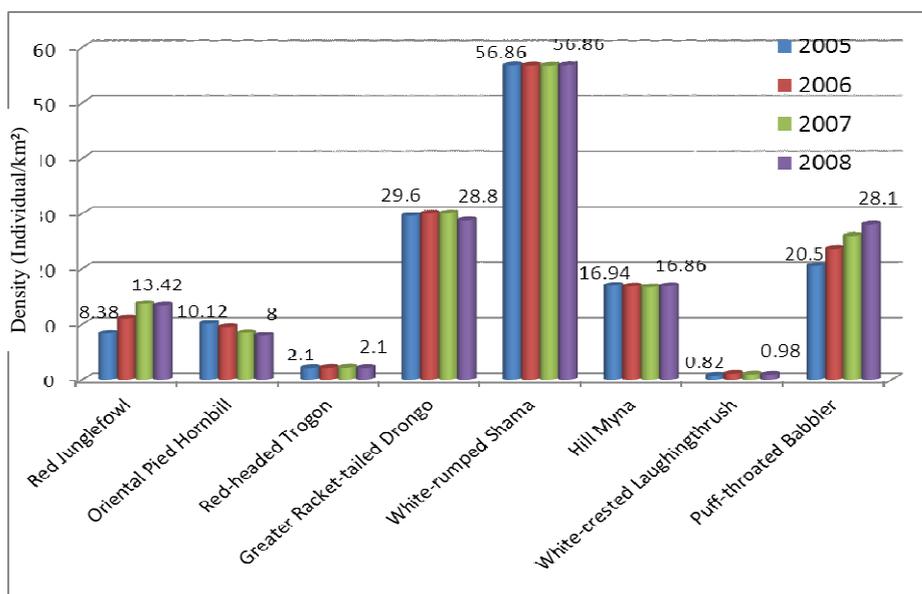


Fig-1: Comparison of the population density of eight indicator bird species across five pilot PA sites in 2005- 2008 (NSP 2008).

Table 2: Density of indicator birds (birds/km²) in 5 pilot (NSP) PA sites during 2005-08

Lawachara NP

SI	Indicator birds	2005	2006	2007	2008
1	Red Junglefowl	7.2	10.7	13.1	14
2	Oriental Pied Hornbill	14.3	13.2	12	11.1
3	Red-headed Trogon	3.9	3.9	4	3.9
4	Greater Racket-tailed Drongo	31.1	31.9	32.2	25.4
5	White-rumped Shama	90	90	90	89.8
6	Hill Myna	21.5	21.2	21.5	21.3
7	White-crested Laughingthrush	0	0	0	0
8	Puff-throated Babbler	26.3	29.6	32.4	34.5

Satchari NP

SI	Indicator birds	2005	2006	2007	2008
1	Red Junglefowl	8.3	11.2	14.1	16.2
2	Oriental Pied Hornbill	15.3	14.9	13.6	12.9
3	Red-headed Trogon	3.4	3.5	3.5	3.5
4	Greater Racket-tailed Drongo	33	33.7	33.8	33.9
5	White-rumped Shama	86.6	87	87	86.8
6	Hill Myna	12.4	13	12.2	12.6
7	White-crested Laughingthrush	0	0	0	0
8	Puff-throated Babbler	33	36.2	38.9	41.4

Rema-Kalenga WS

Sl	Indicator birds	2005	2006	2007	2008
1	Red Junglefowl	8.3	12	14.3	16.1
2	Oriental Pied Hornbill	9.3	8.3	7.1	6.4
3	Red-headed Trogon	2.1	2.2	2.1	2.1
4	Greater Racket-tailed Drongo	36.6	37	36.8	37.2
5	White-rumped Shama	64.9	64.9	64.9	65
6	Hill Myna	11	10.1	10	10.3
7	White-crested Laughingthrush	0	0	0	0
8	Puff-throated Babbler	19	22	24.9	27.1

Chunati WS

Sl	Indicator birds	2005	2006	2007	2008
1	Red Junglefowl	11.8	12.5	16.2	8
2	Oriental Pied Hornbill	0	0	0	0
3	Red-headed Trogon	0	0	0	0
4	Greater Racket-tailed Drongo	10	10	10	10.1
5	White-rumped Shama	23.8	24	23.8	23.9
6	Hill Myna	7.6	7.3	7.3	7.5
7	White-crested Laughingthrush	4.1	5.8	5.1	4.9
8	Puff-throated Babbler	9.8	12.6	14.6	16.4

Teknaf WS

Sl	Indicator birds	2005	2006	2007	2008
1	Red Junglefowl	6.3	9	11	12.8
2	Oriental Pied Hornbill	11.7	11.1	9.7	9.6
3	Red-headed Trogon	1.1	1	1.2	1
4	Greater Racket-tailed Drongo	37.3	37.3	37.3	37.4
5	White-rumped Shama	19	18.2	18.2	18.8
6	Hill Myna	32.2	32.5	32.4	32.6
7	White-crested Laughingthrush	0	0	0	0
8	Puff-throated Babbler	14.4	17.4	19.3	21.1

Context – IPAC bird surveys 2009 and 2010

In five other PAs namely Medakachapia NP, Fasiakhali WS, Kaptai NP, Modhupur NP and Khadimnagar NP indicator bird surveys conducted during 2009 and 2010 with same expertise and methods. Almost constant results exhibit whereas the density of Red Junglefowl shows slight increase (fig-2 and table-3).

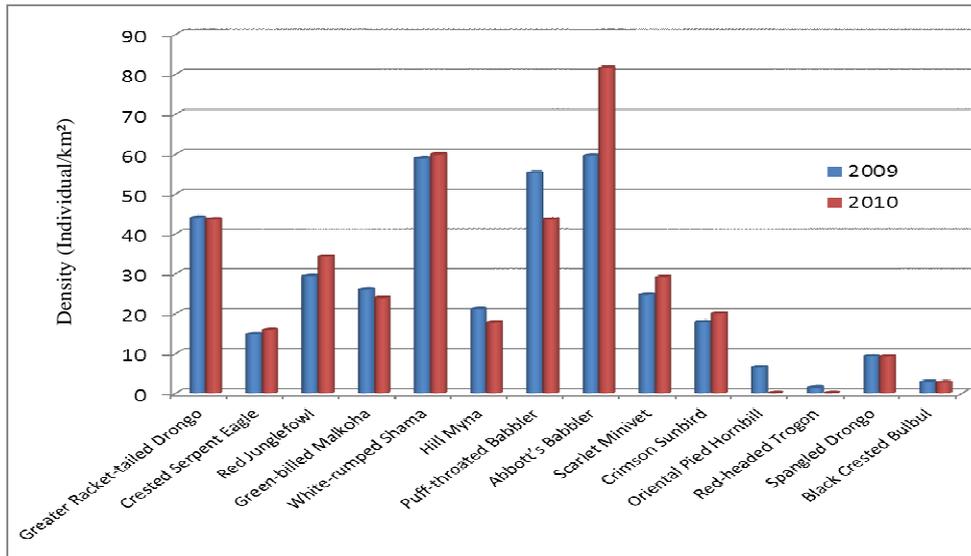


Fig-2: Density of Indication birds (birds/km²) in 5 PAs (IPAC) during 2009-2010

Table 3: Density of Indication birds (birds/km²) in 5 PAs (IPAC) during 2009-2010.

Sl.	Indicator Birds	Kaptai-2009	Kaptai-2010	FKWS-2009	FKWS-2010	MKNP-2009	MKNP-2010
1	Greater Racket-tailed Drongo	13.61	13.50	8.30	8.20	10.20	10.10
2	Crested Serpent Eagle	2.31	3.00	1.90	2.00	2.30	2.40
3	Red Junglefowl	3.70	6.10	4.00	4.60	4.70	5.60
4	Green-billed Malkoha	7.41	5.40	3.40	3.40	4.10	4.00
5	White-rumped Shama	11.57	12.90	9.90	9.70	10.20	10.00
6	Hill Myna	9.26	6.10	3.80	3.60	4.70	4.60
7	Puff-throated Babbler	24.54	12.70	9.70	9.80	8.20	8.40
8	Abbott's Babbler	2.78	24.90	17.60	17.40	15.50	15.50
9	Scarlet Minivet	2.31	6.80	4.10	4.00	6.30	6.20
10	Crimson Sunbird	2.31	4.40	2.70	2.80	2.90	2.90
11	Oriental Pied Hornbill	6.48	-	-	-	-	-
12	Red-headed Trogon	1.39	-	-	-	-	-
13	Spangled Drongo	-	-	-	-	-	-
14	Black Crested Bulbul	-	-	-	-	-	-

SL	Indicator Birds	Khadim-2009	Khadim-2010	Modhupur-2009	Modhupur-2010
1	Greater Racket-tailed Drongo	11.80	11.80	-	-
2	Crested Serpent Eagle	2.20	2.30	6.10	6.10
3	Red Junglefowl	10.70	11.50	6.30	6.40
4	Green-billed Malkoha	4.20	4.40	6.90	6.70
5	White-rumped Shama	11.80	11.90	15.40	15.40
6	Hill Myna	3.30	3.40	-	-
7	Puff-throated Babbler	9.10	9.00	3.70	3.60
8	Abbott's Babbler	20.20	20.30	3.50	3.50
9	Scarlet Minivet	5.90	6.10	6.10	6.00
10	Crimson Sunbird	4.10	4.10	5.80	5.70
11	Oriental Pied Hornbill	-	-	-	-
12	Red-headed Trogon	-	-	-	-
13	Spangled Drongo	-	-	9.30	9.20
14	Black Crested Bulbul	-	-	2.80	2.70

Bird survey June- December 2011 and training to local surveyors

A team of 7 Bbc volunteers led the survey while 25 local bird watchers from 5 protected areas and 3 PMA Research Associates from IPAC actively participated in respective sites. IPAC funded travel and subsistence costs for the Bbc volunteers and daily honorarium to local bird watchers as CMO representatives. . The Bbc members involved varied in their bird watching skills, and thus all the Bbc members and local volunteers received a two day (May 2011) initial training from Dr Monirul Khan on the survey method to ensure identification skills, locate the transects including field sessions in the concerned PAs. Between June and December 2011 a total of 60 days were spent in the field by eight volunteers of Bangladesh Bird Club to undertake transect counts and at the same time further train local volunteer birdwatchers to identify indicator bird species by field characteristics and calls at Medakachapia NP, Fasiakhali WS, Kaptai NP, Modhupur NP and Khadimnagar NP.

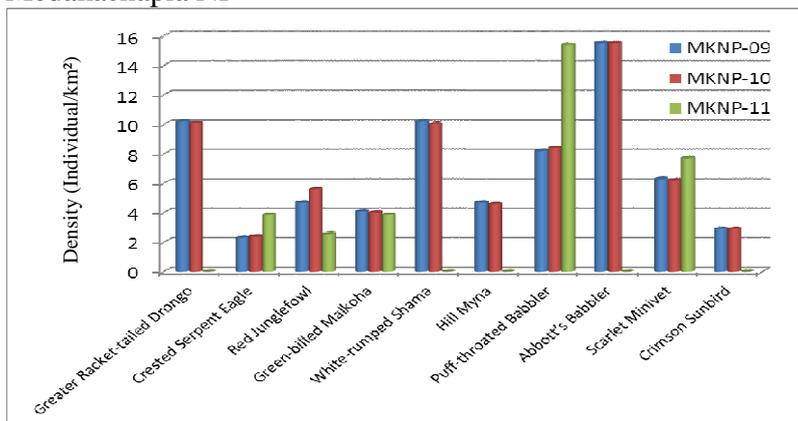
The team of Bbc volunteers comprised of Enam Ul Haque, Samiul Mohsanin, Sayam U. Chowdhury, Shibly Sadik (Kaptai National Park, Fasiakhali Wildlife Sanctuary and Medakachapia National Park), Saad Mahmood, Tania Khan (Khadimnagar National Park) Md Foysal and Omar Uzzal Shahadat (Madhupur National Park). IPAC team includes PMA Research Associates Shital K. Nath (Kaptai NP, Fasiakhali WS and Medakachapia NP), Md. Omar Sharif (Khadimnagar NP) and Ranjit K. Sarker (Modhupur NP) and Monitoring Specialist Ruhul Mohaiman co-ordinated the field surveys and analysis.

Although the same survey method, indicator birds and transects were applied, some of the results show considerable differences from the two previous years of counts (fig-3 a-e and table-4). Possible reasons could be: changes in bird populations associated with

habitat changes or other factors (but changes between 2009 and 2010 were negligible), differences in bird identification and counting skills, differences in understanding of transects and inconsistencies in actual method followed (but this is unlikely), or differences due to the 2011 survey covering a later period of year than the two previous surveys.

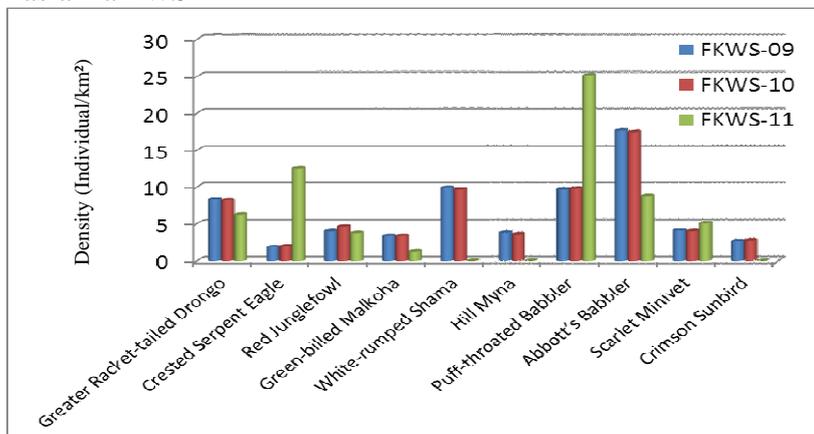
Fig-3: Density of Indication birds (birds/km²) in 5 PAs (IPAC) during June-Dec/2011 in compare to 2009-2010.

Medakachapia NP



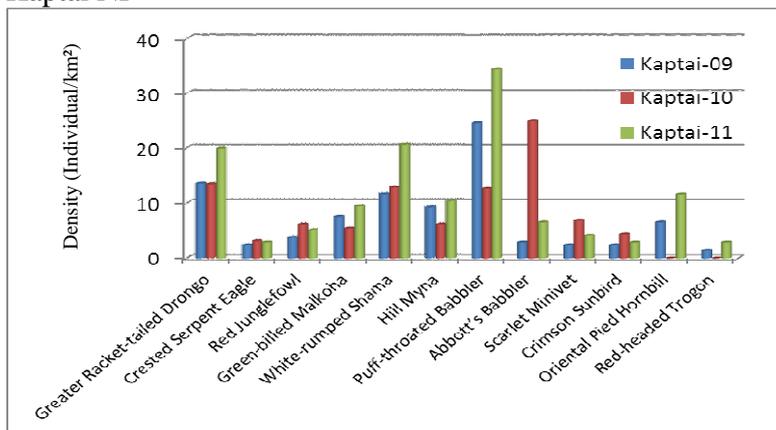
The results for several species are of the same order of magnitude as 2009 and 2010. But they suggest that the number of Puff-throated babbler has increased greatly while two other understorey species appear to have disappeared (White-rumped Shama and Abbott's Babbler) the implications for health of forest undergrowth are unclear. The absence of Greater Racket-tailed Drongo and Crimson Sunbird suggest the quality of the middle strata has been largely degraded. The increase of Scarlet Minivet and the decrease or disappearance of Hill Myna make it difficult to determine the status of the upper strata. However, a pair of globally VULNERABLE Great Slaty Woodpecker (*Mulleripicus pulverulentus*) was observed, indicating that the forest still supports globally significant species.

Fasiakhali WS



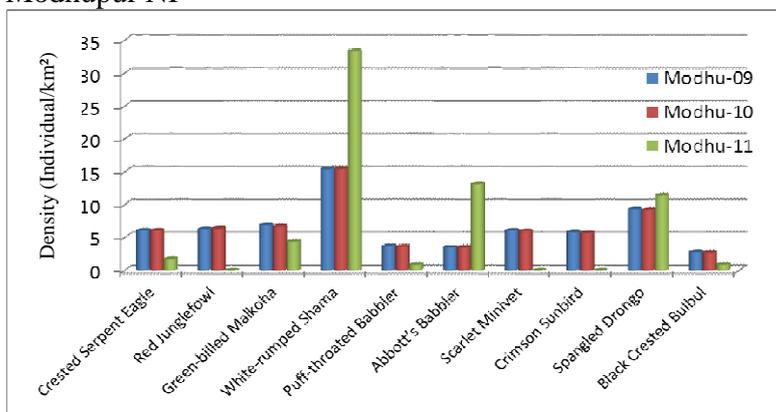
The higher number of Puff-throated Babbler indicates an increase in scrubby vegetation, possibly reflecting positive sign of regeneration with steady density of Red Junglefowl. However, middle strata indicator species Greater Racket-tailed Drongo, White-rumped Shama, Crimson Sunbird and Green-billed Malkoha show sharp decline in numbers. A decrease was also observed in upper canopy species like Scarlet Minivet with no record of Hill Myna. Higher detection of Crested Serpent Eagle is of uncertain implications, and it is possible that calling birds present outside the transect belts were recorded in 2011.

Kaptai NP



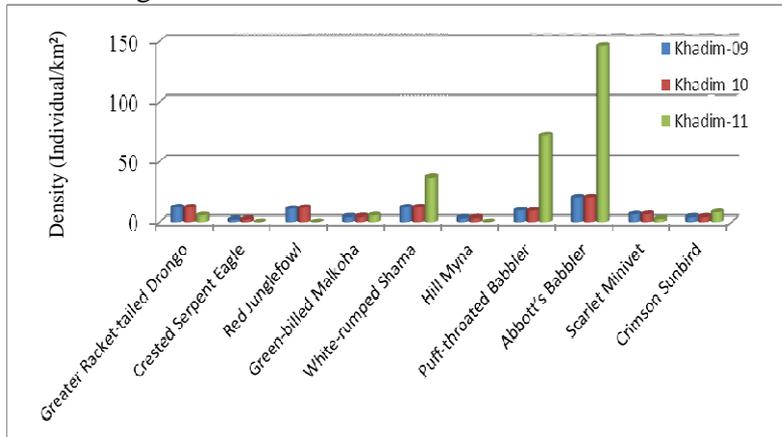
The density of most of the indicator species remain somewhat steady with an increase in upper and middle canopy species such as Oriental Pied Hornbill, White-rumped Shama and Greater Racket-tailed Drongo. Moreover the differences in densities of Puff-throated and Abbott's babbler between 2009 and 2010 suggest that considerable fluctuations in population estimates can arise and may not be due to differences between surveyors, potential interaction effects between these two species are unknown. In addition, the globally VULNERABLE Great Slaty Woodpecker (*Mulleripicus pulverulentus*) was observed during almost all the visits.

Modhupur NP



The higher density of middle and lower strata species like White-rumped Shama, Spangled Drongo and Abbott's Babbler could indicate better health of the lower strata of the forest, but the decline in the nectar feeder (Crimson Sunbird), suggests a lack of flowering species. Other species remained more or less steady over the years.

Khadimnagar NP



Findings from 2011 compared with the two previous years are uncertain. Very high counts of Puff-throated and Abbott's Babblers seem implausible given the range of densities recorded in other sites and years (maxima of 40/km² and 20/km² respectively). Inconsistencies in the method are possible, and this requires further investigation in the 2012 surveys. But it may be that the scrubby and bushy habitats have improved resulting in rapid increases in their populations, while the overall health of the forest remained unchanged.

Table 4: Density of Indication birds (birds/km²) in 5 PAs (IPAC) during June-Dec/2011 in compare to 2009-2010.

SI	Indicator Birds	MKN P-09	MKN P-10	MKN P-11	FKW S-09	FKW S-10	FKW S-11	Kaptai -09	Kaptai -10	Kaptai -11	
1	Greater Racket-tailed Drongo	10.20	10.10	0.00	8.30	8.20	6.29	13.61	13.50	19.91	
2	Crested Serpent Eagle	2.30	2.40	3.85	1.90	2.00	12.58	2.31	3.00	2.78	
3	Red Junglefowl	4.70	5.60	2.56	4.00	4.60	3.77	3.70	6.10	5.09	
4	Green-billed Malkoha	4.10	4.00	3.85	3.40	3.40	1.26	7.41	5.40	9.49	
5	White-rumped Shama	10.20	10.00	0.00	9.90	9.70	0.00	11.57	12.90	20.60	
6	Hill Myna	4.70	4.60	0.00	3.80	3.60	0.00	9.26	6.10	10.37	
7	Puff-throated Babbler	8.20	8.40	15.38	9.70	9.80	25.16	24.54	12.70	34.35	
8	Abbott's Babbler	15.50	15.50	0.00	17.60	17.40	8.81	2.78	24.90	6.48	
9	Scarlet Minivet	6.30	6.20	7.69	4.10	4.00	5.03	2.31	6.80	4.17	
10	Crimson Sunbird	2.90	2.90	0.00	2.70	2.80	0.00	2.31	4.40	2.78	
11	Oriental Pied Hornbill							-	6.48	-	11.57
12	Red-headed							-	1.39	-	2.78

	Trogon									
13	Spangled Drongo						-			
14	Black Crested Bulbul						-			

Sl.	Indicator Birds	Modhu-09	Modhu-10	Modhu-11	Khadim-09	Khadim-10	Khadim-11
1	Greater Racket-tailed Drongo	-	-	-	11.80	11.80	5.13
2	Crested Serpent Eagle	6.10	6.10	1.75	2.20	2.30	0.00
3	Red Junglefowl	6.30	6.40	-	10.70	11.50	0.00
4	Green-billed Malkoha	6.90	6.70	4.39	4.20	4.40	5.13
5	White-rumped Shama	15.40	15.40	33.33	11.80	11.90	37.18
6	Hill Myna			-	3.30	3.40	0.00
7	Puff-throated Babbler	3.70	3.60	0.88	9.10	9.00	71.79
8	Abbott's Babbler	3.50	3.50	13.16	20.20	20.30	146.15
9	Scarlet Minivet	6.10	6.00	-	5.90	6.10	2.56
10	Crimson Sunbird	5.80	5.70	-	4.10	4.10	7.69
11	Oriental Pied Hornbill	-	-	-	-	-	-
12	Red-headed Trogon	-	-	-	-	-	-
13	Spangled Drongo	9.30	9.20	11.40	-	-	-
14	Black Crested Bulbul	2.80	2.70	0.88	-	-	-

Capacity Building of Local Surveyors

IPAC selected a total of 25 local surveyors to attend the training program. These individuals were trained to identify indicator as well as common forest birds and were introduced with the survey method. Their performances 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. Overall the selected candidates were good but they need more practices. Based on their field performance we are confident that at least two trainees from each of the PA sites should be able to carry out further indicator bird surveys if appropriate field equipment is provided such as field guide, binoculars, jungle boot, notebook, carrying bag etc.

Table 5: Performance of local surveyors assessed by Bbc volunteers.

Name	Categories				
	Leadership	Skill	Interest	Punctuality	Communication
<i>Kaptai National Park</i>					
Mr. Kazi Makhsudur Rahaman Babul	High	Medium	High	High	High
Mr. Korimuddin	High	High	High	High	High
Mr. Sumon Marma	High	Medium	High	High	High
Mr. U Sing Marma	High	Medium	High	medium	High
Mr. Mong Sing Marma	High	High	High	High	High
<i>Medakachapia National Park</i>					
Mr. Shafiullah	High	Medium	High	High	Medium
Mr. Amirul Azam	High	High	High	High	Medium
Md. Nurul Amin	High	Medium	High	High	Medium
Md. Jubaier	High	Medium	High	High	Medium
Ms. Sumi Akter	Low	Medium	Medium	Medium	Medium
<i>Fasiakhali Wildlife Sanctuary</i>					
Mr. Shafiullah	High	Medium	High	High	Medium
Mr. Amirul Azam	High	High	High	High	Medium
Md. Nurul Amin	High	Medium	High	High	Medium
Md. Jubaier	High	Medium	High	High	Medium
Ms. Sumi Akter	Low	Medium	Medium	Medium	Medium
<i>Khadimnagar National Park</i>					
Mr. Nadim	High	High	High	High	High
Mr. Bilash	High	High	High	High	High
Shipen Goalla	High	medium	High	High	High
Mr. Mostofa Mia	High	Low	medium	High	Medium
Mr. Lilu	High	Low	medium	medium	High
<i>Modhupur National Park</i>					
Md. Julhas Uddin	High	Medium	High	High	Medium
Abdul Hakim	Medium	Medium	High	High	Medium
Abul Kalam Azad	High	High	High	High	High
Lojesh Mri	High	High	High	High	High
Meshbah ul Haque	High	Medium	High	High	Medium

Conclusion and Recommendations

Loss of habitat through illegal felling, collection of firewood and conversion of natural forest to monoculture are the primary threats to the birds and their habitats in all the five sites. In all the sites, especially in Kaptai NP and Medakacapia NP illegal felling were observed during the survey and training in 2011. A mature forest patch along Bangchhari transect of Kaptai NP was completely wiped out for Agar (*Aquileria agalocha*) plantation. This patch was an important breeding and roosting site for rare resident species such as Pin-tailed Green Pigeon (*Treron apicauda*) and Green Imperial Pigeon (*Ducula aenea*). It is important to note that many fruiting trees including Chapalish (*Artocarpus chaplasha*) are now being targeted by illegal tree fellers and this poses a huge threat to frugivorous birds and mammals if it continues.

It is important to prepare a list of native fruiting and flowering trees for each of the PAs and their habitat types and organize replanting/restoration of these trees in the PAs and in forest and other lands around the protected areas.

Generally volunteers from Bbc have been able to conduct a standardized survey of indicator forest bird populations, but the lack of existing birdwatchers living near to most of the PAs makes it difficult for existing birdwatchers to adopt PAs for long-term monitoring. An important assessment of method will be to determine how few repeat counts of transects are needed and in which months. If only 2 or 3 counts along each transect will be sufficient to give reasonable annual population estimates this would considerably reduce the task for volunteers whether from the bird club or from the local community. Further monitoring activities might be conducted in early period of the breeding season ideally twice (dawn and dusk) per transect each month between March - May as it is often difficult to carry out surveys during rainy or cloudy days and some transects (especially Bangchhari, Rampahar Stream and Rampahar Hill of Kaptai National Park) are inaccessible from June onward with the onset of monsoon.

Involving local community members in bird monitoring is a positive approach for birds and their habitat conservation. 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. By involving them with local university and school students for joint field trips, where the local volunteers will show their area and the birds which will create further attachments to the monitoring. If further training takes place then separate sessions focused on birds and their importance for the forest and wetlands ecosystems 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 by showing birds to the visitors and can simultaneously conduct transects as part of their time in the forest; b) developing linkages between Bbc and local nature clubs or CMCs directly so that interested Bbc members adopt a PA and commit to annual monitoring. In addition the option of monitoring in the same way indicator primates as well as bird species may be considered.

Reference

- Browder, S.F. Johnson, D.H. and Ball, I.J. 2002. Assemblages of breeding birds as indicators of grassland condition. *Ecol. Indicators* 2(2002): 257-270.
- Canterbury, G.E., Martin, T.E. Petit, D.R., Petit, L.J. and Bradford, D.F. 2000. Bird communities and habitat as ecological indicators of forest condition in regional monitoring. *Conserv. Biol.* 14(2): 544-558.
- Grimmett, R., Inskipp, C. and Inskipp, T. 1999. Pocket Guide to the Birds of the Indian Subcontinent. Oxford University Press, New Delhi.
- Johnston, D.W., and Odum, E.P. 1956. Breeding bird populations in relation to plant succession on the Piedmont of Georgia. *Ecology* 37: 50-62.
- Morrison, M.L. 1986. Bird populations as indicators of environmental changes. *Current Ornith.* 3: 429-451.
- NSP 2008. Participatory Bird Survey to Assess Protected Area Management Impacts: Final Year Report; Nishrorgo Support Project; International Resources Group (IRG), Dhaka 2008.
- Temple, S.A. and Wiens, J.A. 1989. Bird populations and environmental changes: can birds be bio-indicators? *Amer. Birds* 43: 260-270.
- Welsh, D.A. 1987. Birds as indicators of forest stand condition in boreal forests of eastern Canada. Pp. 259-267 in A.W. Diamond and F.L. Fibon, eds. The value of birds. Technical publ. 6, International Council for Bird Preservation, Cambridge.

Annex 1: Transects in five forest PA sites

Name of PA Site	Name of Transect	Transect Location in PA	Geographic Locations of Two Ends	Landmarks at Two Ends	Length (km)
<i>Kaptai National Park</i>	Rampahar Stream	Northwest	22°29.709' N, 92°11.123' E;	Balurchar, intersection	1.8
			22°30.469' N, 92°10.440' E		
	Rampahar Hill	West	22°30.469' N, 92°10.440' E;	Intersection, culvert	1.1
			22°29.880' N, 92°10.583' E		
	Jamaichara	Southwest	22°29.668' N, 92°10.683' E;	Karnaphuli south bank, narrow pass	0.61
			22°29.345' N, 92°10.752' E		
Rangamati Road	Centre	22°30.663' N, 92°12.451' E;	Milestone, forest end	0.69	
		22°30.937' N, 92°12.182' E			
Bangchari	Centre	22°30.040' N, 92°11.697' E;	Main road, Debachari	3	
		22°31.576' N, 92°11.138' E			
<i>Fasiakhali Wildlife Sanctuary</i>	Lama Road	Centre	21°43.090' N, 92°05.516' E;	Cox's Bazar Road, culvert	1.7
			21°42.761' N, 92°06.408' E		
	Natunpahar East	West	21°42.338' N, 92°04.765' E;	Natunpahar mosque, Garzanbunia	0.95
			21°42.369' N, 92°05.315' E		
<i>Meda-Kacchapia National Park</i>	Meda-Kacchapia East	East	21°38.484' N, 92°04.402' E;	Cox's Bazar road, Kurahari	1.2
			21°38.329' N, 92°05.080' E		
	Meda-Kacchapia West	West	21°38.632' N, 92°04.392' E;	Cox's Bazar Road, Kacchapia office	1.4
			21°38.783' N, 92°03.592' E		
<i>Khadimnagar National Park</i>	Kalagool Road	West	24°57.248' N, 91°56.311' E;	Khadimnagar office, Kalagool	1.5
			24°56.673' N, 91°55.689' E		
	Khadimnagar Central	Centre	24°56.677' N, 91°56.391' E;	South border, Khadimnagar office	1.1
			24°57.248' N, 91°56.311' E		
	Choragang Road	East	24°57.248' N, 91°56.311' E;	Hindur Jhiri, brick field	1.91
			24°56.975' N, 91°57.198' E		
<i>Madhupur National Park</i>	Rasulpur	East	24°41.342' N, 90°08.350' E;	Rasulpur office, Koia Pukur	2.3
			24°41.488' N, 90°07.015' E		
	Jalui	East	24°41.342' N, 90°08.350' E;	Rasulpur office, Jalui office	1.5
			24°40.779' N, 90°07.683' E		
	Lahoria	Centre	24°41.730' N, 90°06.283' E;	Lahoria office, west intersection	0.9
			24°41.631' N, 90°05.760' E		
	Monar Bide	West	24°40.211' N, 90°06.287' E;	Metalled road, Gaira	1.1
			24°40.811' N, 90°06.137' E		

Annex 2: List of birds recorded in five forest PA sites during June-December, 2011

SI No.	English and Scientific name	Kaptai NP	Medakachapia NP	Fasiakhali WS	Khadimnagar NP	Modhupur NP
1	White-cheeked Partridge <i>Arborophila atrogularis</i>	√				
2	Red Junglefowl <i>Gallus gallus</i>	√	√			√
3	Kalij Pheasant <i>Lophura leucomelanos</i>	√			√	
4	Grey Peacock-Pheasant <i>Polyplectron bicalcaratum</i>	√				
5	Barred Buttonquail <i>Turnix suscitator</i>	√				
6	White-browed Piculet <i>Sasia ochracea</i>	√				
7	Rufous Woodpecker <i>Celeus brachyurus</i>	√				√
8	Great Slaty Woodpecker <i>Mulleripicus pulverulentus</i>	√	√			
9	Speckled Piculet <i>Picumnus innominatus</i>	√				
10	Fulvous-breasted Woodpecker <i>Dendrocopos macei</i>					√
11	Greater Yellownape <i>Picus flavinucha</i>	√				
12	Grey-headed Woodpecker <i>Picus canus</i>	√				
13	Black-rumped Flameback <i>Dinopium benghalense</i>		√			
14	Greater Flameback <i>Chrysocolaptes lucidus</i>	√		√		√
15	Lineated Barbet <i>Megalaima lineata</i>	√				√
16	Blue-throated Barbet <i>Megalaima asiatica</i>	√				
17	Blue-eared Barbet <i>Megalaima australis</i>	√				
18	Coppersmith Barbet <i>Megalaima haemacephala</i>		√			√
19	Oriental Pied Hornbill <i>Anthracoceros albirostris</i>	√				
20	Red-headed Trogon <i>Harpactes erythrocephalus</i>	√				
21	Indian Roller <i>Coracias benghalensis</i>	√	√	√		√
22	Common Kingfisher <i>Alcedo atthis</i>	√	√			√
23	Blue-eared Kingfisher <i>Alcedo meninting</i>	√				
24	White-throated Kingfisher <i>Halcyon smyrnensis</i>		√	√		√
25	Stork-billed Kingfisher <i>Pelargopsis capensis</i>			√		√
26	Pied Kingfisher <i>Ceryle rudis</i>		√			

SI No.	English and Scientific name	Kaptai NP	Medakachapia NP	Fasiakhali WS	Khadimnagar NP	Modhupur NP
27	Green Bee-eater <i>Merops orientalis</i>		√	√		
28	Blue-tailed Bee-eater <i>Merops philippinus</i>	√				
29	Chestnut-headed Bee-eater <i>Merops leschenaulti</i>	√				
30	Violet Cuckoo <i>Chrysococcyx xanthorhynchus</i>	√				
31	Asian Koel <i>Eudynamys scolopacea</i>	√				√
32	Green-billed Malkoha <i>Phaenicophaeus tristis</i>	√	√	√	√	√
33	Greater Coucal <i>Centropus sinensis</i>	√				√
34	Lesser Coucal <i>Centropus bengalensis</i>	√		√		√
35	Red-breasted Parakeet <i>Psittacula alexandri</i>	√	√	√		
36	Asian Palm Swift <i>Cypsiurus balasiensis</i>			√		
37	Fork-tailed Swift <i>Apus pacificus</i>		√			
38	Mountain Scops Owl <i>Otus spilocephalus</i>	√				
39	Oriental Scops Owl <i>Otus sunia</i>		√			
40	Asian Barred Owlet <i>Glaucidium cuculoides</i>	√				
41	Green Imperial Pigeon <i>Ducula aenea</i>	√		√		
42	Spotted Dove <i>Streptopelia chinensis</i>	√	√	√		√
43	Red Collared Dove <i>Streptopelia tranquebarica</i>			√		
44	Emerald Dove <i>Chalcophaps indica</i>	√			√	
45	Pin-tailed Green Pigeon <i>Treron apicauda</i>	√				
46	Pompadour Green Pigeon <i>Treron pompadora</i>	√				
47	Wood Sandpiper <i>Tringa glareola</i>		√			
48	Common Sandpiper <i>Actitis hypoleucos</i>		√			
49	Red-wattled Lapwing <i>Vanellus indicus</i>		√			
50	Yellow-wattled Lapwing <i>Vanellus malabaricus</i>					√
51	Whiskered Tern <i>Chlidonias hybridus</i>		√			
52	Crested Goshawk <i>Accipiter trivigatus</i>				√	
53	Black Baza <i>Aviceda leuphotes</i>	√				
54	Black-shouldered Kite <i>Elanus caeruleus</i>					√
55	Crested Serpent Eagle <i>Spilornis cheela</i>	√	√	√	√	√
56	Shikra <i>Accipiter badius</i>	√			√	

SI No.	English and Scientific name	Kaptai NP	Medakachapia NP	Fasiakhali WS	Khadimnagar NP	Modhupur NP
57	Changeable Hawk Eagle <i>Spizaetus cirrhatus</i>	√				√
58	Little Egret <i>Egretta garzetta</i>	√	√			
59	Intermediate Egret <i>Mesophoyx intermedia</i>		√			
60	Cinnamon Bittern <i>Ixobrychus cinnamomeus</i>			√		
61	Black Bittern <i>Dupetor flavicollis</i>			√		
62	Asian Fairy Bluebird <i>Irena puella</i>	√				
63	Golden-fronted Leafbird <i>Chloropsis aurifrons</i>	√				√
64	Long-tailed Shrike <i>Lanius schach</i>		√	√		√
65	Grey-backed Shrike <i>Lanius tephronotus</i>	√	√			
66	Common Green Magpie <i>Cissa chinensis</i>	√				
67	Rufous Treepie <i>Dendrocitta vagabunda</i>		√	√		√
68	House Crow <i>Corvus splendens</i>	√	√	√		
69	Large-billed Crow <i>Corvus macrorhynchos</i>	√	√	√		
70	Ashy Woodswallow <i>Artamus fuscus</i>	√	√	√		√
71	Black-hooded Oriole <i>Oriolus xanthornus</i>	√	√	√		√
72	Maroon Oriole <i>Oriolus traillii</i>		√			
73	Large Cuckooshrike <i>Coracina macei</i>	√		√		√
74	Rosy Minivet <i>Pericrocotus roseus</i>		√			√
75	Ashy Minivet <i>Pericrocotus divaricatus</i>	√				
76	Small Minivet <i>Pericrocotus cinnamomeus</i>		√	√		√
77	Scarlet Minivet <i>Pericrocotus flammeus</i>	√	√	√		
78	White-throated Fantail <i>Rhipidura albicollis</i>	√				√
79	Black Drongo <i>Dicrurus macrocercus</i>	√	√	√		√
80	Bronzed Drongo <i>Dicrurus aeneus</i>	√	√			√
81	Lesser Racket-tailed Drongo <i>Dicrurus remifer</i>	√				√
82	Greater Racket-tailed Drongo <i>Dicrurus paradiseus</i>	√		√	√	
83	Spangled Drongo <i>Dicrurus hottentottus</i>	√				√
84	Black-naped Monarch <i>Hypothymis azurea</i>	√		√	√	√
85	Common Iora <i>Aegithina tiphia</i>	√	√	√		√
86	Large Woodshrike <i>Tephrodornis gularis</i>					√

SI No.	English and Scientific name	Kaptai NP	Medakachapia NP	Fasiakhali WS	Khadimnagar NP	Modhupur NP
87	Common Woodshrike <i>Tephrodornis pondicerianus</i>					√
88	Orange-headed Thrush <i>Zoothera citrina</i>					√
89	Taiga Flycatcher <i>Ficedula albicilla</i>	√	√	√		
90	Grey-headed Canary Flycatcher <i>Culicicapa ceylonensis</i>	√				√
91	Oriental Magpie Robin <i>Copsychus saularis</i>	√	√	√		√
92	White-rumped Shama <i>Copsychus malabaricus</i>	√			√	√
93	Black-backed Forktail <i>Enicurus immaculatus</i>	√				
94	Common Stonechat <i>Saxicola torquata</i>			√		
95	Pied Bushchat <i>Saxicola caprata</i>	√	√	√		
96	Chestnut-tailed Starling <i>Sturnus malabaricus</i>	√				
97	Asian Pied Starling <i>Sturnus contra</i>	√	√	√		√
98	Common Myna <i>Acridotheres tristis</i>	√	√	√		√
99	Bank Myna <i>Acridotheres ginginianus</i>					√
100	Jungle Myna <i>Acridotheres fuscus</i>	√	√	√		√
101	Hill Myna <i>Gracula religiosa</i>	√				
102	Great Tit <i>Parus major</i>	√				
103	Sand Martin <i>Riparia riparia</i>			√		
104	Barn Swallow <i>Hirundo rustica</i>	√	√	√		√
105	Black-crested Bulbul <i>Pycnonotus melanicterus</i>	√				√
106	Red-whiskered Bulbul <i>Pycnonotus jocosus</i>	√		√		√
107	Red-vented Bulbul <i>Pycnonotus cafer</i>	√	√	√		√
108	Olive Bulbul <i>Iole virescens</i>	√				
109	Rufescent Prinia <i>Prinia rufescens</i>	√				
110	Grey-breasted Prinia <i>Prinia hodgsonii</i>		√	√		
111	Oriental White-eye <i>Zosterops palpebrosus</i>		√	√		
112	Common Tailorbird <i>Orthotomus sutorius</i>	√	√	√		√
113	Dark-necked Tailorbird <i>Orthotomus atrogularis</i>	√		√		
114	Greenish Warbler <i>Phylloscopus trochiloides</i>	√				
115	Blyth's Leaf Warbler <i>Phylloscopus reguloides</i>	√				
116	Golden-spectacled Warbler (Complex) <i>Seicercus sp.</i>	√				
117	White-crested Laughingthrush <i>Garrulax leucolophus</i>			√		

SI No.	English and Scientific name	Kaptai NP	Medakachapia NP	Fasiakhali WS	Khadimnagar NP	Modhupur NP
118	Lesser Necklaced Laughingthrush <i>Garrulax moniliger</i>	√		√		
119	Greater Necklaced Laughingthrush <i>Garrulax pectoralis</i>	√				
120	Rufous-necked Laughingthrush <i>Garrulax ruficollis</i>			√		
121	Abbott's Babbler <i>Malacocincla abbotti</i>	√			√	√
122	Puff-throated Babbler <i>Pellorneum ruficeps</i>	√	√		√	√
123	Striped Tit Babbler <i>Macronous gularis</i>	√		√	√	
124	Grey-throated Babbler <i>Stachyris nigriceps</i>	√				
125	Large Scimitar Babbler <i>Pomatorhinus hypoleucos</i>	√				
126	Jungle Babbler <i>Turdoides striata</i>					√
127	White-bellied Epronis <i>Yuhina xantholeuca</i>	√				
128	Yellow-vented Flowerpecker <i>Dicaeum chrysorrheum</i>	√				
129	Pale-billed Flowerpecker <i>Dicaeum erythrorhynchus</i>	√	√	√		
130	Scarlet-backed Flowerpecker <i>Dicaeum cruentatum</i>	√	√	√		
131	Ruby-cheeked Sunbird <i>Anthreptes singalensis</i>	√				
132	Purple-rumped Sunbird <i>Nectarinia zeylonica</i>		√			
133	Crimson Sunbird <i>Aethopyga siparaja</i>	√			√	
134	Little Spiderhunter <i>Arachnothera longirostra</i>	√			√	
135	House Sparrow <i>Passer domesticus</i>	√	√			
136	Forest Wagtail <i>Dendronanthus indicus</i>	√				
137	White Wagtail <i>Motacilla alba</i>		√			
138	Baya Weaver <i>Ploceus philippinus</i>	√	√			
139	White-rumped Munia <i>Lonchura striata</i>	√				
140	Black-headed Munia <i>Lonchura malacca</i>			√		

Annex 3: Detailed counts of indicator birds at five PA sites

01. Kaptai National Park

Indicator Bird & Transect name	Length (Km)	Width (Km)	Area (Km ²)	Date							Mean	Density (bird/km ²)
				19 May 2011	29-30 Jun 2011	16-18 Aug 2011	16-18 Sep 2011	14-15 Oct 2011	19-21 Nov 2011	28-29 Dec 2011		
				count	count	count	count	count	count	count		
Greater Racket-tailed Drongo												
Rampahar Stream	1.80	0.05	0.09	1		2	0	2	3	0	1.33	14.81
Rampahar Hill	1.10	0.05	0.06	0		1	3	0	0	4	1.33	24.24
Jamaichara	0.61	0.05	0.03									0.00
Rangamati Road	0.69	0.05	0.03	3	0	1	0	2	1	2	1.29	37.27
Bangchari	3.00	0.05	0.15	3	3	2	0	0	0	0	1.14	7.62
Overall	7.20	0.05	0.36	7	3	6	3	4	4	6	5.10	14.15
Crested Serpent Eagle												
Rampahar Stream	1.80	0.05	0.09	0	0	0	0	0	1	0	0.14	1.59
Rampahar Hill	1.10	0.05	0.06	0	0	0	0	0	0	0	0.00	0.00
Jamaichara	0.61	0.05	0.03									0.00
Rangamati Road	0.69	0.05	0.03	1	1	0	0	0	1	0	0.43	12.42
Bangchari	3.00	0.05	0.15	0	0	1	0	0	0	0	0.14	0.95
Overall	7.20	0.05	0.36	1	1	1	0	0	2	0	0.71	1.98
Red Junglefowl												
Rampahar Stream	1.80	0.05	0.09	1	0	0	0	0	0	0	0.14	1.59
Rampahar Hill	1.10	0.05	0.06	0	0	0	0	0	0	0	0.00	0.00
Jamaichara	0.61	0.05	0.03									0.00
Rangamati Road	0.69	0.05	0.03	1	0	0	3	0	2	0	0.86	24.84
Bangchari	3.00	0.05	0.15	1	0	0	0	0	0	0	0.14	0.95
Overall	7.20	0.05	0.36	3	0	0	3	0	2	0	1.14	3.17

Green-billed Malkoha												
Rampahar Stream	1.80	0.05	0.09	1	0	3	0	1	2	0	1.00	11.11
Rampahar Hill	1.10	0.05	0.06	0	0	0	0	0	1	0	0.14	2.60
Jamaichara	0.61	0.05	0.03									0.00
Rangamati Road	0.69	0.05	0.03	1	0	1	1	0	1	0	0.57	16.56
Bangchari	3.00	0.05	0.15	0	3	0	0	0	1	0	0.57	3.81
Overall	7.20	0.05	0.36	2	3	4	1	1	5	0	2.29	6.35

White-rumped Shama												
Rampahar Stream	1.80	0.05	0.09	5	0	3	0	0	0	0	1.14	12.70
Rampahar Hill	1.10	0.05	0.06	0	0	0	0	2	3	1	0.86	15.58
Jamaichara	0.61	0.05	0.03									0.00
Rangamati Road	0.69	0.05	0.03	3	4	0	0	1	1	0	1.29	37.27
Bangchari	3.00	0.05	0.15	0	0	2	0	1	0	0	0.43	2.86
Overall	7.20	0.05	0.36	8	4	5	0	4	4	1	3.71	10.32

Hill Myna												
Rampahar Stream	1.80	0.05	0.09	0	0	2	0	0	0	0	0.29	3.17
Rampahar Hill	1.10	0.05	0.06	0	0	0	1	0	0	0	0.14	2.60
Jamaichara	0.61	0.05	0.03									
Rangamati Road	0.69	0.05	0.03	0	0	2	2	3	3	3	1.86	53.83
Bangchari	3.00	0.05	0.15	0	0	2	0	2	3	0	1.00	6.67
Overall	7.20	0.05	0.36	0	0	6	3	5	6	3	3.29	9.13

Puff-throated Babbler												
Rampahar Stream	1.80	0.05	0.09	4	0	7	0	3	3	0	2.43	26.98
Rampahar Hill	1.10	0.05	0.06	2	0	0	0	0	0	2	0.57	10.39
Jamaichara	0.61	0.05	0.03									0.00
Rangamati Road	0.69	0.05	0.03	6	0	2	6	0	2	0	2.29	66.25
Bangchari	3.00	0.05	0.15	0	5	5	2	4	2	0	2.57	17.14
Overall	7.20	0.05	0.36	12	5	14	8	7	7	2	7.86	21.83

Abbott's Babbler												
Rampahar Stream	1.80	0.05	0.09	1	0	1	0	0	0	0	0.29	3.17
Rampahar Hill	1.10	0.05	0.06	0	0	0	0	0	0	0	0.00	0.00
Jamaichara	0.61	0.05	0.03									0.00
Rangamati Road	0.69	0.05	0.03	1	0	0	0	0	0	0	0.14	4.14
Bangchari	3.00	0.05	0.15	0	2	1	0	0	0	0	0.43	2.86
Overall	7.20	0.05	0.36	2	2	2	0	0	0	0	0.86	2.38

Scarlet Minivet												
Rampahar Stream	1.80	0.05	0.09	0	0	2	0	0	2	1	0.71	7.94
Rampahar Hill	1.10	0.05	0.06	1	0	0	0	0	0	0	0.14	2.60
Jamaichara	0.61	0.05	0.03									0.00
Rangamati Road	0.69	0.05	0.03	0	0	0	0	0	0	0	0.00	0.00
Bangchari	3.00	0.05	0.15	0	0	0	0	0	0	0	0.00	0.00
Overall	7.20	0.05	0.36	1	0	2	0	0	2	1	0.86	2.38

Crimson Sunbird												
Rampahar Stream	1.80	0.05	0.09	2	0	0	0	1	0	1	0.57	6.35
Rampahar Hill	1.10	0.05	0.06	0	0	0	0	0	0	0	0.00	0.00
Jamaichara	0.61	0.05	0.03									0.00
Rangamati Road	0.69	0.05	0.03	0	0	0	0	0	2	0	0.29	8.28
Bangchari	3.00	0.05	0.15	0	0	0	0	0	0	0	0.00	0.00
Overall	7.20	0.05	0.36	2	0	0	0	1	2	1	0.86	2.38

Oriental Pied Hornbill												
Rampahar Stream	1.80	0.05	0.09	3	0	0	3	0	0		1.00	11.11
Rampahar Hill	1.10	0.05	0.06	0	0	0	3	1	0		0.67	12.12
Jamaichara	0.61	0.05	0.03									0.00
Rangamati Road	0.69	0.05	0.03	0	0	0	2	0	0		0.33	9.66
Bangchari	3.00	0.05	0.15	2	0	0	0	0	0		0.33	2.22
Overall	7.20	0.05	0.36	5	0	0	8	1	0	0	2.33	6.48

Red-headed Trogon												
Rampahar Stream	1.80	0.05	0.09	1	0	0	0	0	0		0.17	1.85
Rampahar Hill	1.10	0.05	0.06	0	0	0	0	0	0		0.00	0.00
Jamaichara	0.61	0.05	0.03									0.00
Rangamati Road	0.69	0.05	0.03	0	0	0	2	0	0		0.33	9.66
Bangchari	3.00	0.05	0.15	0	0	0	0	0	0		0.00	0.00
Overall	7.20	0.05	0.36	1	0	0	2	0	0	0	0.50	1.39

02. Fasiakhali Wildlife Sanctuary

Indicator Bird & Transect name	Length (km)	Width (km)	Area (km ²)	18-19 May 2011	2 July 2011	20-21 Aug 2011	20-21 Sept 2011	17 Oct 2011	18 Nov 2011	01 Jan 2012	Mean	Density (bird/km ²)
				count	count	count	count	count	count	count		
Greater Racket-tailed Drongo												
Lama Road	1.70	0.05	0.09	0	3	0	0	0	2	1	0.86	10.08
Natunpahar East	0.95	0.05	0.05	0	0	0	0	0	0	2	0.29	6.02
Overall	2.65	0.05	0.13	0	3	0	0	0	2	3	1.14286	8.63

Crested Serpent Eagle												
Lama Road	1.70	0.05	0.09	0	2	3	2	1	1	0	1.29	15.13
Natunpahar East	0.95	0.05	0.05	0	0	0	1	0	0	0	0.14	3.01
Overall	2.65	0.05	0.13	0	2	3	3	1	1	0	1.43	10.78

Red Junglefowl												
Lama Road	1.70	0.05	0.09	0	0	0	0	1	2	1	0.57	6.72
Natunpahar East	0.95	0.05	0.05	0	0	0	0	0	0	0	0.00	0.00
Overall	2.65	0.05	0.13	0	0	0	0	1	2	1	0.57	4.31

Green-billed Malkoha												
Lama Road	1.70	0.05	0.09	0	0	1	0	0	0	0	0.14	1.68
Natunpahar East	0.95	0.05	0.05	0	0	0	0	0	0	0	0.00	0.00
Overall	2.65	0.05	0.13	0	0	1	0	0	0	0	0.14	1.08

White-rumped Shama												
Lama Road	1.70	0.05	0.09	0	0	0	0	0	0	0	0.00	0.00
Natunpahar East	0.95	0.05	0.05	0	0	0	0	0	0	0	0.00	0.00
Overall	2.65	0.05	0.13	0	0	0	0	0	0	0	0.00	0.00

Hill Myna												
Lama Road	1.70	0.05	0.09	0	0	0	0	0	0	0	0.00	0.00
Natunpahar East	0.95	0.05	0.05	0	0	0	0	0	0	0	0.00	0.00
Overall	2.65	0.05	0.13	0	0	0	0	0	0	0	0.00	0.00

Puff-throated Babbler												
Lama Road	1.70	0.05	0.09	0	0	3	7	3	0	0	1.86	21.85
Natunpahar East	0.95	0.05	0.05	1	3	0	0	2	1	0	1.00	21.05
Overall	2.65	0.05	0.13	1	3	3	7	5	1	0	2.86	21.56

Abbott's Babbler												
Lama Road	1.70	0.05	0.09	0	1	3	3	0	0	0	1.00	11.76
Natunpahar East	0.95	0.05	0.05	0	0	0	0	0	0	0	0.00	0.00
Overall	2.65	0.05	0.13	0	1	3	3	0	0	0	1.00	7.55

Scarlet Minivet												
Lama Road	1.70	0.05	0.09	0	0	4	0	0	0	1	0.71	8.40
Natunpahar East	0.95	0.05	0.05	0	0	0	0	0	0	0	0.00	0.00
Overall	2.65	0.05	0.13	0	0	4	0	0	0	1	0.71	5.39

Crimson Sunbird												
Lama Road	1.70	0.05	0.09	0	0	0	0	0	0	0	0.00	0.00
Natunpahar East	0.95	0.05	0.05	0	0	0	0	0	0	1	0.14	3.01
Overall	2.65	0.05	0.13	0	0	0	0	0	0	1	0.14	1.08

03. Medakachapia National Park

Indicator Bird & Transect name	Length (km)	Width (km)	Area (km ²)	Not surveyed	3 July 2011	19-20 Aug 2011	19-20 Sep 2011	16 Oct 2011	17 Nov 2011	01 Jan 2012	Mean	Density (bird/km ²)
				count	count	count	count	count	count			
Greater Racket-tailed Drongo												
Medakachapia East	1.20	0.05	0.06	0	0	0	0	0	0	0	0.00	0.00
Medakachapia West	1.40	0.05	0.07	0	0	0	0	0	0	0	0.00	0.00
Overall	2.60	0.05	0.13	0	0	0	0	0	0	0	0.00	0.00

Crested Serpent Eagle												
Medakachapia East	1.20	0.05	0.06	0	0	1	0	1	0	0	0.29	4.76
Medakachapia West	1.40	0.05	0.07	0	0	0	0	0	1	0	0.14	2.04
Overall	2.60	0.05	0.13	0	0	1	0	1	1	0	0.43	3.30

Red Junglefowl												
Medakachapia East	1.20	0.05	0.06	0	0	0	0	0	1	0	0.14	2.38
Medakachapia West	1.40	0.05	0.07	0	0	0	0	0	1	0	0.14	2.04
Overall	2.60	0.05	0.13	0	0	0	0	0	2	0	0.29	2.20

Green-billed Malkoha												
Medakachapia East	1.20	0.05	0.06	0	0	1	1	0	1	0	0.43	7.14
Medakachapia West	1.40	0.05	0.07	0	0	0	0	0	0	0	0.00	0.00
Overall	2.60	0.05	0.13	0	0	1	1	0	1	0	0.43	3.30

White-rumped Shama												
Medakachapia East	1.20	0.05	0.06	0	0	0	0	0	0	0	0.00	0.00
Medakachapia West	1.40	0.05	0.07	0	0	0	0	0	0	0	0.00	0.00
Overall	2.60	0.05	0.13	0	0	0	0	0	0	0	0.00	0.00

Hill Myna												
Medakachapia East	1.20	0.05	0.06	0	0	0	0	0	0	0	0.00	0.00
Medakachapia West	1.40	0.05	0.07	0	0	0	0	0	0	0	0.00	0.00
Overall	2.60	0.05	0.13	0	0	0	0	0	0	0	0.00	0.00

Puff-throated Babbler												
Medakachapia East	1.20	0.05	0.06	0	2	3	0	2	0	0	1.00	16.67
Medakachapia West	1.40	0.05	0.07	0	2	0	3	0	0	0	0.71	10.20
Overall	2.60	0.05	0.13	0	4	3	3	2	0	0	1.71	13.19

Abbott's Babbler												
Medakachapia East	1.20	0.05	0.06	0	0	0	0	0	0	0	0.00	0.00
Medakachapia West	1.40	0.05	0.07	0	0	0	0	0	0	0	0.00	0.00
Overall	2.60	0.05	0.13	0	0	0	0	0	0	0	0.00	0.00

Scarlet Minivet												
Medakachapia East	1.20	0.05	0.06	0	0	1	1	2	2	0	0.86	14.29
Medakachapia West	1.40	0.05	0.07	0	0	0	0	0	0	0	0.00	0.00
Overall	2.60	0.05	0.13	0	0	1	1	2	2	0	0.86	6.59

Crimson Sunbird												
Medakachapia East	1.20	0.05	0.06	0	0	0	0	0	0	0	0.00	0.00
Medakachapia West	1.40	0.05	0.07	0	0	0	0	0	0	0	0.00	0.00
Overall	2.60	0.05	0.13	0	0	0	0	0	0	0	0.00	0.00

04. Khadimnagar National Park

Indicator Bird & Transect name	Length (km)	Width (km)	Area (km ²)	Not surveyed	7-9 June 2011	10-11 July 2011	4-5 Aug 2011	18-19 Aug 2011	29-30 Sept 2011	Not surveyed	2-4 Dec 2011	14-17 Jan 2012	Mean	Density (bird/km ²)
				count	count	count	count	count	count	count	count			
Greater Racket-tailed Drongo														
Kalagol Road	1.50	0.05	0.08		2	1	0	0	0		0	0	0.43	5.71
Khadimnagar Central	1.10	0.05	0.06		0	0	0	0	0		1	0	0.14	2.60
Choragang Road	1.91	0.05	0.10		1	0	0	0	0		1	0	0.29	2.99
Overall	2.60	0.05	0.13	0	2			0	0	0	1	0	0.57	4.40

Crested Serpent Eagle														
Kalagol Road	1.50	0.05	0.08		0	0	0	0	0		0	0	0.00	0.00
Khadimnagar Central	1.10	0.05	0.06		0	0	0	0	0		0	0	0.00	0.00
Choragang Road	1.91	0.05	0.10		0	1	1	0	0		0	0	0.29	2.99
Overall	2.60	0.05	0.13	0	0			0	0	0	0	0	0.00	0.00

Red Junglefowl														
Kalagol Road	1.50	0.05	0.08		0	0	0	0	0		0	0	0.00	0.00
Khadimnagar Central	1.10	0.05	0.06		0	0	0	0	0		0	0	0.00	0.00
Choragang Road	1.91	0.05	0.10		0	0	0	0	0		0	0	0.00	0.00
Overall	2.60	0.05	0.13	0	0			0	0	0	0	0	0.00	0.00

Green-billed Malkoha														
Kalagol Road	1.50	0.05	0.08		0	1	0	0	1		0	0	0.29	3.81
Khadimnagar Central	1.10	0.05	0.06		0	1	1	0	0		0	0	0.29	5.19
Choragang Road	1.91	0.05	0.10		1	0	0	1	1		0	0	0.43	4.49
Overall	2.60	0.05	0.13	0	0			0	1	0	0	0	0.57	4.40

White-rumped Shama														
Kalagol Road	1.50	0.05	0.08		12	3	4	2	2		2	1	3.71	49.52
Khadimnagar Central	1.10	0.05	0.06		0	1	3	0	0		0	0	0.57	10.39
Choragang Road	1.91	0.05	0.10		6	2	4	3	0		0	0	2.14	22.44
Overall	2.60	0.05	0.13	0	12			2	2	0	2	1	4.29	32.97

Hill Myna														
Kalagol Road	1.50	0.05	0.08		0	0	0	0	0		0	0	0.00	0.00
Khadimnagar Central	1.10	0.05	0.06		0	0	0	0	0		0	0	0.00	0.00
Choragang Road	1.91	0.05	0.10		0	0	0	0	0		0	0	0.00	0.00
Overall	2.60	0.05	0.13	0	0			0	0	0	0	0	0.00	0.00

Puff-throated Babbler														
Kalagol Road	1.50	0.05	0.08		4	9	10	6	10		2	3	6.29	83.81
Khadimnagar Central	1.10	0.05	0.06		0	0	7	2	4		2	3	2.57	46.75
Choragang Road	1.91	0.05	0.10		13	9	11	6	3		3	2	6.71	70.31
Overall	2.60	0.05	0.13	0	4			8	14	0	4	6	8.86	68.13

Abbott's Babbler														
Kalagol Road	1.50	0.05	0.08		24	13	8	9	17		14	10	13.57	180.95
Khadimnagar Central	1.10	0.05	0.06		0	5	5	6	7		6	9	5.43	98.70
Choragang Road	1.91	0.05	0.10		13	11	10	5	9		10	12	10.00	104.71
Overall	2.60	0.05	0.13	0	24			15	24	0	20	19	19.00	146.15

Scarlet Minivet														
Kalagol Road	1.50	0.05	0.08		0	0	0	0	0		2	0	0.29	3.81
Khadimnagar Central	1.10	0.05	0.06		0	0	0	0	0		0	1	0.14	2.60
Choragang Road	1.91	0.05	0.10		0	0	0	0	0		2	1	0.43	4.49
Overall	2.60	0.05	0.13	0	0			0	0	0	2	1	0.43	3.30

Crimson Sunbird														
Kalagol Road	1.50	0.05	0.08		0	0	1	0	1		1	1	0.57	7.62
Khadimnagar Central	1.10	0.05	0.06		0	1	0	1	1		0	2	0.71	12.99
Choragang Road	1.91	0.05	0.10		0	0	0	0	1		6	4	1.57	16.45
Overall	2.60	0.05	0.13	0	0			1	2	0	1	3	1.29	9.89

05. Modhupur National Park

Indicator Bird & Transect name	Length (km)	Width (km)	Area (km ²)	11-13 May 2011	30 Jun-1 Jul 2011	27-29 Aug 2011	20-22 Sept 2011	22-24 Oct 2011	27-29 Nov 2011	Mean	Density (bird/km ²)
				count	count	count	count	count	count		
Crested Serpent Eagle											
Rasulpur	2.30	0.05	0.12	0	0	0	0	0	0	0.00	0.00
Jalui	1.50	0.05	0.08	1	1	0	0	0	0	0.33	4.44
Lahoria	0.90	0.05	0.05		0		0	0	0	0.00	0.00
Monar Bide	1.10	0.05	0.06	1	0		0	0	0	0.20	3.64
Overall	3.80	0.05	0.19	1	1	0	0	0	0	0.33	1.75

Red Junglefowl											
Rasulpur	2.30	0.05	0.12	0	0	0	0	0	0	0.00	0.00
Jalui	1.50	0.05	0.08	0	0	0	0	0	0	0.00	0.00
Lahoria	0.90	0.05	0.05		0		0	0	0	0.00	0.00
Monar Bide	1.10	0.05	0.06	0	0		0	0	0	0.00	0.00
Overall	3.80	0.05	0.19	0	0	0	0	0	0	0.00	0.00

Green-billed Malkoha											
Rasulpur	2.30	0.05	0.12	0	1	0	1	0	1	0.50	4.35
Jalui	1.50	0.05	0.08	1	1	0	0	0	0	0.33	4.44
Lahoria	0.90	0.05	0.05		0		0	1	1	0.50	11.11
Monar Bide	1.10	0.05	0.06	0	0		0	0	0	0.00	0.00
Overall	3.80	0.05	0.19	1	2	0	1	0	1	0.83	4.39

Spangled Drongo											
Rasulpur	2.30	0.05	0.12	1	2	0	0	0	4	1.17	10.14
Jalui	1.50	0.05	0.08	1	0	0	0	3	2	1.00	13.33
Lahoria	0.90	0.05	0.05		0		0	0	0	0.00	0.00
Monar Bide	1.10	0.05	0.06	0	0		0	0	0	0.00	0.00
Overall	3.80	0.05	0.19	2	2	0	0	3	6	2.17	11.40

White-rumped Shama											
Rasulpur	2.30	0.05	0.12	4	9	2	6	3	2	4.33	37.68
Jalui	1.50	0.05	0.08	1	3	1	2	5	0	2.00	26.67
Lahoria	0.90	0.05	0.05		2		1	2	0	1.25	27.78
Monar Bide	1.10	0.05	0.06	0	0		0	0	0	0.00	0.00
Overall	3.80	0.05	0.19	5	12	3	8	8	2	6.33	33.33

Black Crested Bulbul											
Rasulpur	2.30	0.05	0.12	0	0	0	0	0	1	0.17	1.45
Jalui	1.50	0.05	0.08	0	0	0	0	0	0	0.00	0.00
Lahoria	0.90	0.05	0.05		0		0	0	0	0.00	0.00
Monar Bide	1.10	0.05	0.06	0	0		0	0	0	0.00	0.00
Overall	3.80	0.05	0.19	0	0	0	0	0	1	0.17	0.88

Puff-throated Babbler											
Rasulpur	2.30	0.05	0.12	0	0	1	0	0	0	0.17	1.45
Jalui	1.50	0.05	0.08	0	0	0	0	0	0	0.00	0.00
Lahoria	0.90	0.05	0.05		0		0	0	0	0.00	0.00
Monar Bide	1.10	0.05	0.06	0	0		0	0	0	0.00	0.00
Overall	3.80	0.05	0.19	0	0	1	0	0	0	0.17	0.88

Abbott's Babbler											
Rasulpur	2.30	0.05	0.12	0	1	3	4	2	0	1.67	14.49
Jalui	1.50	0.05	0.08	0	5	0	0	0	0	0.83	11.11
Lahoria	0.90	0.05	0.05		0		0	0	0	0.00	0.00
Monar Bide	1.10	0.05	0.06	0	0		0	0	0	0.00	0.00
Overall	3.80	0.05	0.19	0	6	3	4	2	0	2.50	13.16

Scarlet Minivet											
Rasulpur	2.30	0.05	0.12	0	0	0	0	0	0	0.00	0.00
Jalui	1.50	0.05	0.08	0	0	0	0	0	0	0.00	0.00
Lahoria	0.90	0.05	0.05		0		0	0	0	0.00	0.00
Monar Bide	1.10	0.05	0.06	0	0		0	0	0	0.00	0.00
Overall	3.80	0.05	0.19	0	0	0	0	0	0	0.00	0.00

Crimson Sunbird											
Rasulpur	2.30	0.05	0.12	0	0	0	0	0	0	0.00	0.00
Jalui	1.50	0.05	0.08	0	0	0	0	0	0	0.00	0.00
Lahoria	0.90	0.05	0.05		0		0	0	0	0.00	0.00
Monar Bide	1.10	0.05	0.06	0	0		0	0	0	0.00	0.00
Overall	3.80	0.05	0.19	0	0	0	0	0	0	0.00	0.00