

# Abundance of birds in different habitats in Buxa Tiger Reserve, West Bengal, India

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Buxa Tiger Reserve (26°30–55'N 89°20–55'E) is located in the north-eastern corner of Jalpaiguri district, West Bengal. It covers an area of 760 km<sup>2</sup>, with a core area of 385 km<sup>2</sup> and a buffer zone 375 km<sup>2</sup>. The northern and eastern boundaries of the reserve border Bhutan and Assam respectively. The western and southern boundaries are bordered by tea gardens and agricultural fields (Fig. 1). Biogeographically, the reserve lies in two major zones: the Central Himalayas and Gangetic Plains. Most of the area of the reserve lies in plains, and only the northern tracts are hilly. The elevation ranges from 60 to 1,750 m. There are 37 villages inside the reserve and 33 tea gardens on the fringes. The habitat is primarily tropical moist-deciduous forest dominated by sal *Shorea robusta*. In addition, evergreen, semi-evergreen and riverine forest, scrub and grasslands are found, along with plantations of sal, teak *Tectona grandis*, jarul *Lagerstroemia reginae*, and mixed plantations of native trees. The temperature range is typically 12–32°C and the average annual rainfall is c.4,100 mm.

Previous authors have reported on birds in the reserve (e.g. Stevens 1923–1925, Inglis 1952–1969), with Allen *et al.* (1996) recording a total of 227 species and listing 359 species known from the reserve. We carried out a systematic study during May 2000–July 2001 to determine the species richness and abundance in different habitats. Our observations of threatened species and the results of

waterbird surveys in the reserve have been published elsewhere (Sivakumar 2003, Sivakumar and Prakash 2004).

## METHODS

A total of 12 line transects (Caughley 1977), each 1 km long, were used to survey the avifauna: three in plantations of teak (T2 and T9) and sal (T1), three in semi-evergreen forest (T3, T5 and T8), two in hill forest (T11 and T12) and one each in scrub (T4), riverine forest (T10), forest around a village (T7) and mixed plantation with natural forest (T6). The locations of the transects are marked in Fig. 1 and further details are given elsewhere (Prakash *et al.* 2001). Two observers covered each transect in approximately one hour by walking slowly and counting birds observed on both sides of the transect. Transects were started 30 minutes after sunrise and each transect was walked twice a month i.e. 28 times in total. For all observations, the species, number of individuals, distance from observer, height, behaviour and association with other species were noted. Population densities were calculated as total number of individuals divided by transect length × mean perpendicular distance of observations (Burnham *et al.* 1980).

In addition, a 45-km transect was driven every two weeks during the study period from Damanpur to Checko via Panijora, Pambubusti, Rajabathkawa, Santrabari, Jainty and '23rd mile tower'. A 50 m band on each side of the transect was searched, with one person observing each side from a slow-moving (20km/h) jeep. This survey method is useful for large conspicuous birds that occur in low densities (Sale and Berkmuller 1988).

## RESULTS

A total of 284 species were recorded in Buxa Tiger Reserve during the study period, of which 144 species were recorded during the transects (Appendix 1). Twenty-two species were newly recorded for the reserve (Appendix 2). Species richness was highest in semi-evergreen forest and lowest in teak plantations (Table 1). Overall bird population densities were highest in scrub, followed by village-edge forest (Table 1), and ranged from 0.2 to 658 birds/km<sup>2</sup> (see Appendix), with 73% of species occurring at densities <10 birds/km<sup>2</sup> (Fig. 2). The density of a number of raptor species was calculated from the results of the road transects (Table 2).

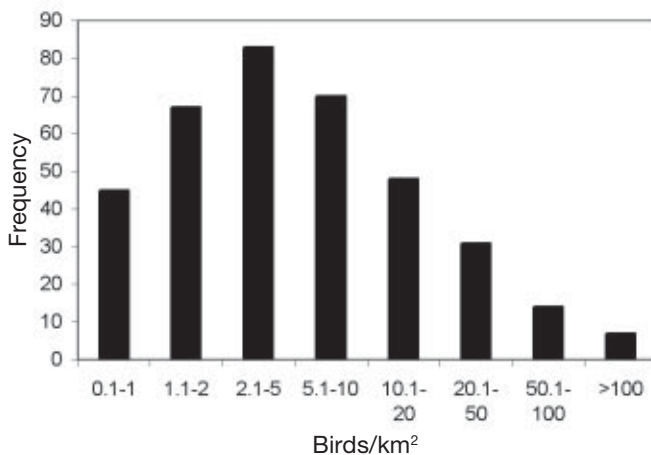
Five threatened and two Near Threatened species were recorded: Lesser Adjutant *Leptoptilos javanicus* (Vulnerable), White-rumped Vulture *Gyps bengalensis* (Critically Endangered), Slender-billed Vulture *Gyps tenuirostris* (Critically Endangered), Chestnut-breasted Partridge *Arborophila mandellii* (Vulnerable), Rufous-



Figure 1. Map of Buxa Tiger Reserve showing location of transects.

**Table 1.** Species richness and overall bird population densities in different habitats of Buxa Tiger Reserve.

	Monoculture plantation	Semi-evergreen forest	Scrub	Mixed plantation/natural forest	Village-edge forest	Riverine forest	Hill forest
No. transects	3	3	1	1	1	1	2
Mean species richness	28.7 (16–48)	51(44–56)	41	49	51	42	26 (23–29)
Mean total bird density (individuals/km <sup>2</sup> )	312 (120–514)	441 (379–549)	1,677	447	1,226	566	468 (438–498)

**Figure 2.** Frequency distribution of bird species densities in Buxa Tiger Reserve.**Table 2.** Density of raptors recorded from road-transects in Buxa Tiger Reserve.

Species	Density (birds/km <sup>2</sup> )
CRESTED SERPENT EAGLE <i>Spilornis cheela</i>	2.8
ORIENTAL HONEY-BUZZARD <i>Pernis ptilorhynchus</i>	2.2
SHIKRA <i>Accipiter badius</i>	1.1
BLACK BAZA <i>Aviceda leuphotes</i>	0.9
JERDON'S BAZA <i>Aviceda jerdoni</i>	1.5
CRESTED GOSHAWK <i>Accipiter trivirgatus</i>	1.6

necked Hornbill *Aceros nipalensis* (Vulnerable) Ferruginous Pochard *Aythya nyroca* (Near Threatened) and Great Hornbill *Buceros bicornis* (Near Threatened). Details of the observation have been published elsewhere (Sivakumar 2003). We did not record Black-necked Crane *Grus nigricollis* or Beautiful Nuthatch *Sitta formosa* (both Vulnerable) which are known from the reserve (Sanyal 1995, Allen *et al.* 1996).

## DISCUSSION

Higher species diversity was found in semi-evergreen forest and mixed plantations than in monoculture plantations, presumably because the simpler structure of the latter provides fewer ecological niches, food types and variety of nest sites (Steyn 1977, Woinarski 1979, Evans 1992). The highest overall bird population densities were recorded in scrub and village-edge forest. This was likely

to have been partly a result of the greater visibility in such habitats, and partly because agricultural activities such as ploughing attracted large numbers of egrets and mynas. Eighty-six percent of species in the present study had densities lower than 20 birds/km<sup>2</sup>, which is comparable with data from an Amazonian rainforest (Thiollay 1994). Some species had exceptionally high densities, e.g. Cattle Egret *Bubulcus ibis* (266 birds/km<sup>2</sup>) and Red-vented Bulbul *Pycnonotus cafer* (659 birds/km<sup>2</sup>). Thiollay (1994) also mentioned that abundant species commonly reach up to 200 pairs/km<sup>2</sup> i.e. 400 birds/km<sup>2</sup>.

Allen *et al.* (1996) recorded 227 species in the reserve and listed a total of 359 species known from it. Of the species recorded by Allen *et al.* (1996), we missed 82 species. These mostly occur at higher altitudes; practical difficulties prevented us from carrying out transects above 1,000 m. We recorded an additional 119 species that Allen *et al.* (1996) did not record, including 22 that were also not recorded by previous workers. Development of monoculture plantations, tea gardens, tree cutting, firewood collection, grass cutting, fires and cattle grazing are some of the threats to birds in Buxa Tiger Reserve (Prakash *et al.* 2001).

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## REFERENCES

- Allen, D., Anderton, J. and Kazmierczak, K. (1996) Report on an ornithological visit to Buxa Tiger Reserve, West Bengal, India, 17 February to 6 March 1992. *Forktail* 12: 47–64.
- Burnham, K. P., Anderson, D. R., and Laake, J. L. (1980) Estimation of density from line transect sampling of biological populations. *Wildlife Monograph* 72: 1–202.
- Caughley, G. (1977) *Analysis of vertebrate populations*. New York: Wiley and Sons.
- Evans, J. (1992) *Plantation forestry in the tropics*. Second edition. Oxford: Clarendon Press.
- Inglis, C. M. (1952–1969) Birds of the duars. *J. Bengal Nat. Hist. Soc.* 25: 121–127, 164–169, 196–200; 26: 1–8, 47–56, 93–99, 149–156; 27: 9–12, 55–58, 83–95, 129–155; 28: 18–51, 102–115, 153–161; 29: 16–25, 88–94, 150–160; 30: 35–42, 81–97, 166–181; 31: 14–32, 49–60; 32: 1–9, 69–73; 33: 121–123, 181–184; 34: 1–4, 85–87; 35: 1–5, 49–63.

- Prakash, V., Sivakumar, S. and Varghese, J. (2001) Avifauna as indicator of habitat quality in Buxa Tiger Reserve (Final report). Mumbai: Bombay Natural History Society.
- Sale, J. B. and Berkemuller, K., eds. (1988) *Manual of wildlife techniques for India*. Field Document No. 11. Dehradun, India: Wildlife Institute of India.
- Sanyal, P. (1995) Rare crane of India. *J. Bombay Nat. Hist. Soc.* 91: 453.
- Sivakumar, S. (2003) Sighting of Red Data Book (RDB) species in Buxa Tiger Reserve during 1998–2001. *Newsletter for Birdwatchers* 43(6): 91.
- Sivakumar, S., and Prakash, V. (2004) Water birds of Buxa Tiger Reserve, West Bengal. *Zoos' Print J.* 19(4):1451–1452.
- Stevens, H. (1923–1925) Notes on the birds of the Sikkim Himalayas. *J. Bombay Nat. Hist. Soc.* 29: 503–518, 723–740, 1007–1030; 30: 54–71, 352–379, 664–685, 872–893.
- Steyn, D. J. (1977) Occupation and use of the Eucalyptus plantations in the Tzaneen area by indigenous birds. *S. Afr. Forestry J.* 100: 56–60.
- Thiollay, J. M. (1994) Structure, density and rarity in an Amazonian rainforest bird community. *J. Trop. Ecol.* 10: 449–481.
- Woinarski, J. K. (1979) Birds of eucalyptus plantation and adjacent natural forest. *Australian Forestry* 42(4): 243–247.

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## APPENDIX 1

Mean population densities (individuals/km<sup>2</sup>) of birds in different habitats in Buxa Tiger Reserve

Species	Monoculture plantation	Semi-evergreen forest	Scrub	Mixed plantation/natural forest	Village-edge forest	Riverine forest	Hill forest
No. transects	3	3	1	1	1	1	2
BLACK FRANCOLIN <i>Francolinus francolinus</i>			8.7				
GREY FRANCOLIN <i>Francolinus pondiceranus</i>							5
RED JUNGLEFOWL <i>Gallus gallus</i>	0.3	2.0		1.1			2.5
INDIAN PEAFOWL <i>Pavo cristatus</i>	0.4		13.0			5.7	
RUFIOUS WOODPECKER <i>Ceileus brachyurus</i>		1.0		1.1			
PALE-HEADED WOODPECKER <i>Gecinulus grantia</i>							2.5
GREY-CAPPED PYGMY WOODPECKER <i>Dendrocopos canicapillus</i>	4.2	1.3		4.3	1.3	1.4	6.7
STRIPE-BREASTED WOODPECKER <i>Dendrocopos atratus</i>		1.0					
LESSER YELLOWNAPE <i>Picus chlorolophus</i>	2.7	7.7			4.0	1.4	
GREATER YELLOWNAPE <i>Picus flavinucha</i>	4.3	3.8				8.6	8.3
GREY-HEADED WOODPECKER <i>Picus canus</i>	1.7	1.7		1.1			6.7
HIMALAYAN FLAMEBACK <i>Dinopium shorii</i>		1.1					
GREATER FLAMEBACK <i>Chrysocolaptes lucidus</i>	0.7	3.1		11.8	5.3	10.0	4.2
GREAT BARBET <i>Megalaima virens</i>							6.7
LINEATED BARBET <i>Megalaima lineata</i>	1.3	5.2		21.5	12.0	37.1	
BLUE-THROATED BARBET <i>Megalaima asiatica</i>		12.5		14.0	8.0	41.4	8.3
ORIENTAL PIED HORNBILL <i>Anthracoceros albirostris</i>	3.7	9.7	6.5	1.1			
COMMON HOPOE <i>Upupa epops</i>			2.2		5.3		
INDIAN ROLLER <i>Coracias benghalensis</i>			6.5		1.3	10.0	
RUDDY KINGFISHER <i>Halcyon coromanda</i>	0.3	0.2					
WHITE-THROATED KINGFISHER <i>Halcyon smyrnensis</i>				3.2	1.3		
BLUE-BEARDED BEE-EATER <i>Nyctornis atheroni</i>	1.8	0.3				1.4	4.2
GREEN BEE-EATER <i>Merops orientalis</i>			6.5			1.4	
BLUE-TAILED BEE-EATER <i>Merops philippinus</i>					22.7		
CHESTNUT-HEADED BEE-EATER <i>Merops leschenaulti</i>				7.5	4.0	12.9	
INDIAN CUCKOO <i>Cuculus micropterus</i>	0.7	0.8				4.3	
LESSER CUCKOO <i>Cuculus poliocephalus</i>						1.4	
ASIAN KOEL <i>Eudynamis scolopacea</i>	0.3			1.1			
GREEN-BILLED MALKOHA <i>Phaenicophaeus tristis</i>	0.3	1.0	2.2		1.3		
GREATER COUCAL <i>Centropus sinensis</i>						1.4	
LESSER COUCAL <i>Centropus bengalensis</i>			2.2				

Species	Monoculture plantation	Semi-evergreen forest	Scrub	Mixed plantation/natural forest	Village-edge forest	Riverine forest	Hill forest
ALEXANDRINE PARAKEET <i>Psittacula eupatria</i>			2.2		5.3		
RED-BREASTED PARAKEET <i>Psittacula alexandri</i>	34.7	30.5			8.0	85.7	
ASIAN PALM SWIFT <i>Cypsiurus balasiensis</i>			6.5		18.7		
ASIAN BARRED OWLET <i>Glaucidium cuculoides</i>	1.3	0.8				5.7	
MOUNTAIN IMPERIAL PIGEON <i>Ducula badia</i>		1.8					12.5
ORIENTAL TURTLE DOVE <i>Streptopelia orientalis</i>	1.1	0.2	23.9	1.1	5.3		
SPOTTED DOVE <i>Streptopelia chinensis</i>			80.4	29.0	116.0		
EURASIAN COLLARED DOVE <i>Streptopelia decaocto</i>			6.5				
BARRED CUCKOO DOVE <i>Macropygia unchall</i>		0.3					
EMERALD DOVE <i>Chalcophaps indica</i>		1.2					
THICK-BILLED GREEN PIGEON <i>Treron curvirostra</i>	1.0	1.5		33.3			
YELLOW-FOOTED GREEN PIGEON <i>Treron phoenicoptera</i>			108.7				
PIN-TAILED GREEN PIGEON <i>Treron apicauda</i>		7.9					
WEDGE-TAILED GREEN PIGEON <i>Treron sphenura</i>		2.6					
WHITE-BREASTED WATERHEN <i>Amaurornis phoenicurus</i>					1.3		
JERDON'S BAZA <i>Aviceda jerdoni</i>		0.8					2.5
CRESTED SERPENT EAGLE <i>Spilornis cheela</i>		0.5	2.2				2.5
CRESTED GOSHAWK <i>Accipiter trivirgatus</i>				1.1			
SHIKRA <i>Accipiter badius</i>	2.7		2.2			1.4	
ORIENTAL HONEY-BUZZARD <i>Pernis ptilorhyncus</i>	0.8						
COLLARED FALCONET <i>Microhierax caerulescens</i>	0.3	3.0			1.3	4.3	
CATTLE EGRET <i>Bubulcus ibis</i>	16.9				266.7		
INDIAN POND HERON <i>Ardeola grayii</i>					4.0		
MALAYAN NIGHT HERON <i>Gorsachius melanolophus</i>	0.4						
SILVER-BREASTED BROADBILL <i>Serilophus lunatus</i>		2.1					
LONG-TAILED BROADBILL <i>Psarisomus dalhousiae</i>		7.9					
ASIAN FAIRY BLUEBIRD <i>Irena puella</i>	0.3	3.4		6.5			
GOLDEN-FRONTED LEAFBIRD <i>Chloropsis aurifrons</i>	0.7	9.8	6.5	15.1	1.3	32.9	37.5
ORANGE-BELLIED LEAFBIRD <i>Chloropsis hardwickii</i>							4.2
BROWN SHRIKE <i>Lanius cristatus</i>			2.2				
LONG-TAILED SHRIKE <i>Lanius schach</i>		0.2	23.9		1.3		
GREY-BACKED SHRIKE <i>Lanius tephronotus</i>	1.0	0.2	8.7	1.1	9.3	5.7	
RUFIOUS TREEPIE <i>Dendrocitta vagabunda</i>	5.1		73.9				12.5
GREY TREEPIE <i>Dendrocitta formosae</i>	4.9	5.8				4.3	2.5
HOUSE CROW <i>Corvus splendens</i>					5.3		
LARGE-BILLED CROW <i>Corvus macrorhynchos</i>	2.0		93.5	7.5	12.0	4.3	
ASHY WOODSWALLOW <i>Artamus fuscus</i>			6.5		44.0	8.6	
BLACK-NAPED ORIOLE <i>Oriolus chinensis</i>	4.0					1.4	
BLACK-HOODED ORIOLE <i>Oriolus xanthornus</i>	20.7	8.6	6.5	9.7	9.3	4.3	
MAROON ORIOLE <i>Oriolus traillii</i>	2.0	17.9		1.1			
LARGE CUCKOOSHRIKE <i>Coracina macei</i>	15.4	1.0	2.2	1.1	14.7	8.6	
BLACK-WINGED CUCKOOSHRIKE <i>Coracina melaschistos</i>	0.3	6.6	8.7	4.3			
SMALL MINIVET <i>Pericrocotus cinnamomeus</i>		4.3		7.5			
SCARLET MINIVET <i>Pericrocotus flammeus</i>	47.1	40.6		53.8	14.7	20.0	37.5
YELLOW-BELLIED FANTAIL <i>Rhipidura hypoxantha</i>		0.3					
BLACK DRONGO <i>Dicrurus macrocerus</i>	1.1		52.2		1.3		8.3
ASHY DRONGO <i>Dicrurus leucophaeus</i>	9.4	6.7		3.2	4.0	20.0	45.8
BRONZED DRONGO <i>Dicrurus aeneus</i>	0.3	1.5					4.2
LESSER RACKET-TAILED DRONGO <i>Dicrurus remifer</i>	3.7	6.4					

Species	Monoculture plantation	Semi-evergreen forest	Scrub	Mixed plantation/natural forest	Village-edge forest	Riverine forest	Hill forest
SPANGLED DRONGO <i>Dicrurus hottentottus</i>	28.7	3.8	2.2	14.0		34.3	8.3
GREATER RACKET-TAILED DRONGO <i>Dicrurus paradiseus</i>	1.3	7.6			1.3		16.7
BLACK-NAPED MONARCH <i>Hypothymis azurea</i>		4.1					
COMMON IORA <i>Aegithina tiphia</i>		2.1		7.5	1.3		
LARGE WOODSHRIKE <i>Tephrodornis gularis</i>	5.7	33.6		4.3	18.7	15.7	2.5
BLUE ROCK THRUSH <i>Monticola solitarius</i>					1.3		
BLUE WHISTLING THRUSH <i>Myophonus caeruleus</i>							8.3
SCALY THRUSH <i>Zoothera dauma</i>		1.2					
DARK-SIDED FLYCATCHER <i>Muscicapa sibirica</i>				1.1		1.4	
RED-THROATED FLYCATCHER <i>Ficedula parva</i>	17.9	3.7		1.1	1.3	42.9	2.5
LITTLE PIED FLYCATCHER <i>Ficedula westermanni</i>				1.1		1.4	
VERDITER FLYCATCHER <i>Eumyias thalassina</i>	0.3			1.1			
SMALL NILTAVA <i>Niltava macgrigoriae</i>		1.2				1.4	
RUFOUS-BELLIED NILTAVA <i>Niltava sundara</i>	1.3	4.1					
PALE-CHINNED FLYCATCHER <i>Cyornis poliogenys</i>		3.5				4.3	
GREY-HEADED CANARY FLYCATCHER <i>Culicicapa ceylonensis</i>	15.8	10.1		14.0	5.3	12.9	
SIBERIAN RUBYTHROAT <i>Luscinia calliope</i>			13.0				
ORIENTAL MAGPIE ROBIN <i>Copsychus saularis</i>				1.1	34.7		
WHITE-RUMPED SHAMA <i>Copsychus malabaricus</i>	0.3	8.1		14.0	1.3		
BLACK REDSTART <i>Phoenicurus ochruros</i>			13.0				
WHITE-TAILED ROBIN <i>Myiomela leucura</i>		1.1					
COMMON STONECHAT <i>Saxicola torquata</i>			2.2				
CHESTNUT-TAILED STARLING <i>Sturnus malabaricus</i>			30.4	3.2	65.3	4.3	
ASIAN PIED STARLING <i>Sturnus contra</i>			71.7		124.0		
COMMON MYNA <i>Acridotheres tristis</i>			95.7		125.3		
JUNGLE MYNA <i>Acridotheres fuscus</i>			19.6		17.3		
HILL MYNA <i>Gracula religiosa</i>	7.2	4.4		3.2	8.0	4.3	10.8
CHESTNUT-BELLIED NUTHATCH <i>Sitta castanea</i>	4.3	12.7			4.0	5.7	10.8
VELVET-FRONTED NUTHATCH <i>Sitta frontalis</i>	1.0	0.2					
GREAT TIT <i>Parus major</i>	0.3	1.4					
GREEN-BACKED TIT <i>Parus monticolus</i>	1.0						
SULTAN TIT <i>Melanochlora sultanea</i>		15.8					
BLACK-CRESTED BULBUL <i>Pycnonotus melanicterus</i>	6.0	16.7		31.2	8.0	58.6	56.7
RED-WHISKERED BULBUL <i>Pycnonotus jocosus</i>			6.5	21.5	80.0		
RED-VENTED BULBUL <i>Pycnonotus cafer</i>			658.7	14.0	93.3	28.6	4.2
WHITE-THROATED BULBUL <i>Alophoixus flaveolus</i>		34.5		9.7			12.5
ASHY BULBUL <i>Hemixos flavala</i>	4.0	1.8					4.2
BLACK BULBUL <i>Hypsipetes leucocephalus</i>							83.3
ORIENTAL WHITE-EYE <i>Zosterops palpebrosus</i>				15.1			
CHESTNUT-HEADED TESIA <i>Tesia castaneocoronata</i>		2.2					
GREY-BELLIED TESIA <i>Tesia cyaniventris</i>	1.0	10.3					
COMMON TAILORBIRD <i>Orthotomus sutorius</i>	1.3	0.3			1.3	5.7	8.3
COMMON CHIFFCHAFF <i>Phylloscopus collybita</i>			2.2				
YELLOW-VENTED WARBLER <i>Phylloscopus cantator</i>		4.4	21.7				
GOLDEN-SPECTACLED WARBLER <i>Seicercus burkii</i>		2.1		1.1			
YELLOW-BELLIED WARBLER <i>Abroscopus superciliaris</i>							4.2
WHITE-CRESTED LAUGHINGTHRUSH <i>Garrulax leucolophus</i>							33.3
GREATER NECKLACED LAUGHINGTHRUSH <i>Garrulax pectoralis</i>	25.0	0.2					
ABBOTT'S BABBLER <i>Malacocincla abbotti</i>		5.0		9.7			

Species	Monoculture plantation	Semi-evergreen forest	Scrub	Mixed plantation/natural forest	Village-edge forest	Riverine forest	Hill forest
PUFF-THROATED BABBLER <i>Pellorneum ruficeps</i>							4.2
PYGMY WREN BABBLER <i>Pnoepyga pusilla</i>		0.3					
STRIPED TIT BABBLER <i>Macronous gularis</i>		4.4		1.1			10.8
JUNGLE BABBLER <i>Turdoides striatus</i>	5.0		152.2				
SILVER-EARED MESIA <i>Leiothrix argentauris</i>		15.9					
WHITE-BELLIED YUHINA <i>Yuhina zantholeuca</i>							12.
PALE-BILLED FLOWERPECKER <i>Dicaeum erythrorhynchos</i>							2.5
PLAIN FLOWERPECKER <i>Dicaeum concolor</i>							2.5
SCARLET-BACKED FLOWERPECKER <i>Dicaeum cruentatum</i>		0.3		15.1			4.2
BLACK-THROATED SUNBIRD <i>Aethopyga saturata</i>							4.2
CRIMSON SUNBIRD <i>Aethopyga siparaja</i>		0.9		18.3			
STREAKED SPIDERHUNTER <i>Arachnothera magna</i>	1.0	8.7		4.3			
OLIVE-BACKED PIPIT <i>Anthus hodgsoni</i>	0.7		19.6				
BAYA WEAVER <i>Ploceus philippinus</i>						18.7	
SCALY-BREASTED MUNIA <i>Lonchura punctulata</i>					4.0		
LITTLE BUNTING <i>Emberiza pusilla</i>						1.8	

## APPENDIX 2

Bird species newly recorded for Buxa Tiger Reserve

BARRED BUTTONQUAIL <i>Turnix suscitator</i>	MALAYAN NIGHT HERON <i>Gorsachius melanolophus</i>
SPOT-BILLED DUCK <i>Anas poecilorhyncha</i>	CINNAMON BITTERN <i>Ixobrychus cinnamomeus</i>
PALE-HEADED WOODPECKER <i>Gecinulus grantia</i>	ASIAN OPENBILL <i>Anastomus oscitans</i>
STRIPE-BREASTED WOODPECKER <i>Dendrocopos atratus</i>	BLACK-NAPED ORIOLE <i>Oriolus chinensis</i>
RUDDY KINGFISHER <i>Halcyon coromanda</i>	CHESTNUT-BELLIED NUTHATCH <i>Sitta castanea</i>
COMMON COOT <i>Fulica atra</i>	SPOTTED LAUGHINGTHRUSH <i>Garrulax ocellatus</i>
EURASIAN GRIFFON <i>Gyps fulvus</i>	RED-BILLED LEIOTHRIX <i>Leiothrix lutea</i>
EASTERN MARSH HARRIER <i>Circus (aeruginosus) spilonotus</i>	OLIVE-BACKED PIPIT <i>Anthus hodgsoni</i>
GOLDEN EAGLE <i>Aquila chrysaetos</i>	BAYA WEAVER <i>Ploceus philippinus</i>
AMUR FALCON <i>Falco amurensis</i>	SCALY-BREASTED MUNIA <i>Lonchura punctulata</i>
LITTLE EGRET <i>Egretta garzetta</i>	LITTLE BUNTING <i>Emberiza pusilla</i>

# Nesting ecology of Cattle Egrets and Little Egrets in Amroha, Uttar Pradesh, India

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Heron species vary in their habitat preferences, diet and behaviour, but they have similar fundamental requirements for nesting (Hafner 2000). A good nesting site generally provides protection against predators, offers adequate stability and materials to support and construct the nest, and is located near adequate feeding areas (Thompson 1977, Beaver *et al.* 1980, Hafner and Britton 1983, Gibbs *et al.* 1987, Hafner *et al.* 1987, Hafner and

Fasola 1992). Nest-site parameters also influence hatching success (Ludwig *et al.* 1994, Kazantzidis *et al.* 1997, Hilaluddin *et al.* 2003) and fledging success (Buckley and Buckley 1980).

Studies of nest-site selection by Cattle Egret *Bubulcus ibis* and Little Egret *Egretta garzetta* have been previously conducted in subtropical North America and in southern Europe (Telfair 1983, Arendt and Arendt 1988,