COMMUNICATION

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Houbaropsis bengalensis (Gmelin, 1789) IN KOSHI TAPPU 
WILDLIFE RESERVE, NEPAL

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Status of the Critically Endangered Bengal Florican

Houbaropsis bengalensis (Gmelin, 1789) in Koshi Tappu Wildlife Reserve, Nepal

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Abstract: The Bengal Florican is one of the rarest bustard species and is listed ‘Critically Endangered’ by the IUCN. The species is restricted to the lowland grasslands of India, Nepal, and Cambodia with fewer than 1,000 mature individuals. To assess the species status in Koshi Tappu Wildlife Reserve, Nepal, we repeated our first comprehensive survey conducted during the 2012 breeding season. In spite of a larger area coverage we recorded only 41 adult Bengal Floricans in 2017 compared to 47 individuals in 2012. Detectability of this rare species is low in its Imperata-Sacccharum grasslands. We, therefore, used a long pole with black and white clothing to mimic Bengal Florican’s display flight to stimulate male Bengal Florican. The number of adult males recorded was the same as in the 2012 survey and the adult male density remains one of the highest in the Indian subcontinent. Management recommendations for the long-term conservation of the species in Koshi Tappu include maintenance of Imperata-Sacccharum grasslands in the reserve favoured by the Bengal Florican and working with farmers and communities adjacent to the reserve where the birds breed in order to maintain some agricultural lands with vegetation height suitable for the species especially during the species’ breeding season.

Keywords: Otidiformes, Otididae, bustard, abundance, terai grasslands, bird, flagship species, threats.

INTRODUCTION

Bengal Florican *Houbaropsis bengalensis* (Gmelin, 1789) is the only member of its genus, and is the rarest member of the bustard order, Otidiformes. The species is classified as Critically Endangered on the IUCN Red List due to the widespread and on-going modification of its grassland habitat (BirdLife International 2018). It is also included on Appendix I of CITES (BirdLife International 2018).

Resident populations of Bengal Florican (Image 1) occur in the floodplain grasslands in Cambodia, India, and Nepal (BirdLife International 2018). The Cambodia population is estimated to be 432 individuals (Packman et al. 2014). The overall population estimate for India is not available, but it is certain to hold a significant population considering the large areas of suitable habitat especially within its northern protected areas. Recent surveys have recorded 72 adult males in Manas Tiger Reserve, Kaziranga and Orang National Parks in Assam and 60–70 territorial male Bengal Floricans are estimated to be present in D’Ering Wildlife Sanctuary in Arunachal Pradesh (BirdLife International 2018).

In Nepal, the species occurs in Shuklaphanta National Park, Bardia National Park, Chitwan National Park, Koshi Tappu Wildlife Reserve, and Koshi Barrage area with a combined population of less than 100 individuals (DNPWC 2016, Figure 1). In Koshi Tappu Wildlife Reserve, the species was occasionally seen in the 1970s (Dahmer 1976) and there were several records from the Koshi Barrage in the early 1980s (Baker 1981; Turton & Speight 1982), but none were sighted after 1986 (Inskipp & Inskipp 1991).

However, in 2011 the Bengal Florican made a comeback to the wildlife reserve. A 2011 survey estimated as many as 12 pairs in Koshi area at nine sites along a 39km north-south stretch of the Koshi River. Out of the total of 17 birds recorded during the survey only five birds were recorded outside the Koshi Tappu Wildlife Reserve. A comprehensive follow-up survey in April and May 2012 counted 47 birds. This represented the largest known population in Nepal, with perhaps the highest density in the Indian subcontinent (Baral et al. 2013).

The main threat to the Bengal Florican in the protected areas in Nepal is improper habitat management by ploughing, intensive burning and grass harvesting leading to a loss of suitable habitat (Poudyal et al. 2008; Baral et al. 2013; DNPWC 2016). The Bengal Florican is a ‘flagship’ species in the Terai grasslands. There is a need to develop a sustainable recovery strategy for the critically threatened Bengal Florican that provides long-term biodiversity benefits not only for the florican but also for other species that rely on the fragile and threatened grassland habitats. An effective strategy needs to establish an improved scientific evidence-base on the dynamics of Bengal Florican population decline, increase regional conservation capacity-building and cooperation, raise awareness, and build legislation for habitat protection, and appropriate management aiming to support optimum population size. Despite years of conservation focus on this species, the population continues to decline elevating the species’ status recently to Critically Endangered from Endangered. A global scenario for the Bengal Florican and other bustard species is adequately presented in a recent publication (Collar et al. 2017).

Following recommendations by Baral et al. (2013), the objective of this study was to assess the change in status of the population of the Bengal Florican in Koshi Tappu Wildlife Reserve and its adjacent areas after a period of five years.

METHODS

Study area

Koshi Tappu Wildlife Reserve (26.65°N & 87.00°E) lies in the floodplain of the Sapta Koshi River in southeastern lowland Nepal (Figure 2). The reserve was officially established in 1976 and extended in 1980 covering an area of 175km². The habitat within Koshi Tappu Wildlife Reserve and its adjacent areas, referred henceforth as Koshi Tappu, is broadly classified as mixed deciduous riverine forest (5.4%), grassland (17.1%), swamp (18.1%),

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Image 1. Bengal Florican *Houbaropsis bengalensis*
Status of Bengal Florican in Koshi Tappu WR

Baral et al.

Figure 1. Distribution of Bengal Florican in Nepal.

Figure 2. Koshi Tappu showing the survey area with four blocks.
river (52.4%), and agricultural land (7.0%) (Dahal et al. 2009). The southern part of the reserve is a large expanse of open water, marshes and reed-beds created by the construction of Koshi barrage between 1958 and 1964 (Limbu & Subba 2011). The reserve is bounded by two parallel embankments, a shorter one to the west and longer one to the east of the Sapta Koshi River and is subject to annual flooding (Baral et al. 2012). Koshi Tappu Wildlife Reserve was Nepal’s first Ramsar site in 1987 (Sah 1997) and is an Important Bird Area (Baral & Inskipp 2005). A total of 526 bird species has been recorded in the area (Baral 2016; Koshi Tappu Wildlife Reserve 2018).

Field method
Prior to the field survey, we identified suitable Bengal Florican habitats in and around Koshi Tappu Wildlife Reserve using Google Earth Image (2016) and reconnaissance survey. We followed the previous 2012 survey design and established four survey blocks (Table 1, Figure 2). Survey blocks A and B were considerably larger, by 30.2km² and 30.4km², respectively, compared to 2012 survey due to the dynamic nature of the floodplain.

The survey was conducted between 23–29 April 2017. The survey blocks were reached either by boat or by a four-wheel vehicle and the surveys were conducted on foot between 05.00–10.00 hr and 15.00–18.00 hr. Bengal Floricans are most active during the early morning and late afternoon and human disturbance is also minimal during these times.

In total 12 experienced surveyors took part in the survey. Each surveyor had a pair of binoculars and forms to record data on sighted birds along with location and habitat information. Additionally, each survey team carried a mobile phone, digital camera and a GPS receiver. Watches were synchronised among team members to record accurate time of Bengal Florican sightings. Each survey team also carried a long pole with black and white clothing to mimic male Bengal Florican display flight. The aim of this was to stimulate male Bengal Floricans to display thus increasing detectability. Sightings of flying birds were communicated to other teams via mobile phones to minimize double counts. The survey covered 168.9km² of the 193km² identified as suitable Bengal Florican habitat in Koshi Tappu.

Enumerating number of Bengal Floricans
Bengal Florican sighting records were checked for double counts using sex, location and time. The species nesting season is from May to August (Oates 1898). We, therefore, assumed that the adult birds had already established territories during the survey and were faithful to their sites. The total number of birds was obtained by adding the total number of birds recorded in each survey block.

Several factors were recognized to be potential biases in counting the Bengal Florican population. Since only adult males displayed, counts were likely to be biased towards males. Grass height varied considerably

### Table 1. Description of survey blocks in Koshi Tappu Wildlife Reserve and its adjacent areas.

<table>
<thead>
<tr>
<th>Block</th>
<th>Sites</th>
<th>Location</th>
<th>Area (km²)</th>
<th>Habitat characteristics</th>
<th>Disturbance level</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Site 1</td>
<td>26.77N 87.10E</td>
<td>4</td>
<td>Saccharum spontaneum with smaller patches of Imperata grasses; within Koshi Tappu Wildlife Reserve and buffer zone</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>Site 2</td>
<td>26.74N 87.12E</td>
<td>14</td>
<td>Saccharum spontaneum with fewer patches of Imperata grasses than site 1; outside Koshi Tappu Wildlife Reserve and buffer zone</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>Site 3</td>
<td>26.77N 87.07E</td>
<td>30.2</td>
<td>Cultivation land with some thatched houses. Few patches of Typha elephantine and short grasses mainly Imperata.</td>
<td>High</td>
</tr>
<tr>
<td>B</td>
<td>Site 1</td>
<td>26.69N 87.09E</td>
<td>30.5</td>
<td>Saccharum spontaneum with a sward height of about 50cm; within Koshi Tappu Wildlife Reserve and buffer zone</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td>Site 2</td>
<td>26.66N 87.09E</td>
<td>6</td>
<td>Saccharum spontaneum with a sward height of about 50cm; within Koshi Tappu Wildlife Reserve and buffer zone</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td>Site 3</td>
<td>26.56N 87.01E</td>
<td>9</td>
<td>Saccharum spontaneum with a sward height of about 50cm; within Koshi Tappu Wildlife Reserve and buffer zone</td>
<td>Medium</td>
</tr>
<tr>
<td>C</td>
<td>Site 1</td>
<td>26.66N 87.04E</td>
<td>12.9</td>
<td>Saccharum and Imperata grasslands with patches of young Dalbergia sissoo and Acacia catechu; within Koshi Tappu Wildlife Reserve and buffer zone</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td>Site 2</td>
<td>26.66N 87.04E</td>
<td>37.3</td>
<td>Medium</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>Site 1</td>
<td>26.63N 87.02E</td>
<td>25</td>
<td>Saccharum and Imperata species; within Koshi Tappu Wildlife Reserve and buffer zone</td>
<td>High</td>
</tr>
</tbody>
</table>

Disturbance was measured in three categorical levels—low, medium, and high.
across the survey area, and we did not correct for detection bias due to variation in visibility. Bias due to different observers, timing of count, and varying levels of human disturbance were also recognized. Potential variability introduced using Bengal Florican dummies was not estimated. The number of Bengal Floricans that had not yet established territories during the survey was unknown. The possibility of birds moving between blocks during the survey period was recognized.

RESULTS

Bengal Florican was recorded in all four surveyed blocks. In total, 41 adult birds were recorded of which 29 birds were male and 12 birds were female. Five birds were recorded outside the Koshi Tappu Wildlife Reserve and its buffer zone, four birds in the buffer zone, and 32 birds in the reserve (Table 2).

The highest number (15 birds) and density (0.33 birds/km$^2$) of Bengal Floricans were recorded in Block B. Only four Bengal Floricans at a density of 0.16 birds/km$^2$ were counted in Block D. In Block A nine adult Bengal Floricans at a density of 0.19/km$^2$ were counted. The survey blocks A and D were the most grazed and disturbed areas, evident by the large number of cattle present and on average, the shortest grass sward height. All the blocks except Block A were within the reserve and buffer zone. Seventy percent of Block A was outside the reserve and buffer zone.

The overall density of the species in the surveyed area was 0.24 birds/km$^2$. Assuming that the un-surveyed area had a density of Bengal Floricans similar to the area covered, we estimated a total population of 46 Bengal Floricans within suitable habitat in Koshi Tappu. Bengal Floricans were only recorded in grasslands predominantly consisting of *Imperata cylindrica* and *Saccharum spontaneum* with a sward height greater than 50cm.

Correction of the Bengal Florican 2012 survey estimate (Baral et al. 2013)

We found that the area of Block C reported by Baral et al. (2013) was much larger than its actual size. Based on area calculated using QGIS 2.18 (QGIS Development Team 2004), we revised this to 50km$^2$ (105km$^2$ was reported in Baral et al. 2013). The revised estimated density of Bengal Floricans in Koshi Tappu for 2012 was 0.43 bird/km$^2$ (Table 3).

DISCUSSION

We counted fewer adult Bengal Floricans (41 birds) in Koshi Tappu over a larger area (168.9km$^2$) compared to the previous survey in 2012 (Baral et al. 2013, 47 birds in 108.1km$^2$). This indicates a 13% decline over five years.

The survey found a 2.42 male to female sex ratio. It is not unusual to find a higher number of males compared to females in populations of globally threatened bird

<table>
<thead>
<tr>
<th>Sampling block</th>
<th>Area (km$^2$)</th>
<th>Number of adult male Bengal Floricans counted</th>
<th>Number of adult female Bengal Floricans counted</th>
<th>Total number of adult Bengal Floricans counted</th>
<th>Estimated adult density (birds / km$^2$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block A</td>
<td>48.2</td>
<td>6</td>
<td>3</td>
<td>9</td>
<td>0.19</td>
</tr>
<tr>
<td>Block B</td>
<td>45.5</td>
<td>10</td>
<td>5</td>
<td>15</td>
<td>0.33</td>
</tr>
<tr>
<td>Block C</td>
<td>50.2</td>
<td>10</td>
<td>3</td>
<td>13</td>
<td>0.26</td>
</tr>
<tr>
<td>Block D</td>
<td>25</td>
<td>3</td>
<td>1</td>
<td>4</td>
<td>0.16</td>
</tr>
<tr>
<td>Total</td>
<td>168.9</td>
<td>29</td>
<td>12</td>
<td>41</td>
<td>0.24</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sampling block</th>
<th>Area (km$^2$)</th>
<th>Number of male Bengal Floricans counted</th>
<th>Number of female Bengal Floricans counted</th>
<th>Total number of Bengal Floricans counted</th>
<th>Estimated density (birds / km$^2$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block A</td>
<td>18</td>
<td>9</td>
<td>5</td>
<td>14</td>
<td>0.78</td>
</tr>
<tr>
<td>Block B</td>
<td>15.1</td>
<td>5</td>
<td>3</td>
<td>8</td>
<td>0.53</td>
</tr>
<tr>
<td>Block C</td>
<td>50</td>
<td>14</td>
<td>9</td>
<td>23</td>
<td>0.46</td>
</tr>
<tr>
<td>Block D</td>
<td>25</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>0.08</td>
</tr>
<tr>
<td>Total</td>
<td>108.1</td>
<td>29</td>
<td>18</td>
<td>47</td>
<td>Average total density 0.43</td>
</tr>
</tbody>
</table>
species (Donald 2007). Further studies are required to understand reasons for the higher percentage of male Bengal Florican sightings. Comparing the density of adult male Bengal Floricans as a proxy of Bengal Florican population density across the various sites in southern and southeastern Asia, Koshi Tappu continues to remain one of the strongholds for the species (Table 4).

Previous studies have reported species dependence on *Saccharum-Imperata* assemblage during the breeding season (Inskipp & Inskipp 1983; Baral 2001; Poudyal et al. 2008). This study also found higher density of Bengal Floricans in *Saccharum-Imperata* grassland assemblage with sward height of about 50cm. Detailed studies on grassland ecology combined with studies on the ecology of the Bengal Florican are necessary to understand their habitat preferences which can guide management intervention to maintain viable populations (Baral et al. 2013).

The species faces a number of threats in Nepal. Very small areas of suitable habitat remain, and these are mainly within protected areas. At present, the grasslands of Koshi Tappu Wildlife Reserve and Shuklaphanta National Park provide the best habitats for this species. In Chitwan and Bardia National Parks, single habitat patches suitable for Bengal Florican have been reduced to less than 50ha. Even in protected areas, the species is threatened by improper habitat management by ploughing, grass harvesting and intensive burning, leading to a loss of suitable habitat (Poudyal et al. 2008). Other significant threats are disturbance (overgrazing), susceptibility to predation and hunting (Poudyal et al. 2008). In addition, the invasive alien plant species *Mikania micrantha* which can smother grasslands, has had serious impact on Chitwan National Park and Koshi Tappu Wildlife Reserve habitats (Siwakoti 2007; Baral & Adhikari 2017). At Koshi, feral dogs, fern and wood collectors and an unnatural increase in native predators, Asiatic Golden Jackal *Canis aureus* and Indian Grey Mongoose *Herpestes edwardsi*, are additional threats (Baral et al. 2013). Both native predators have increased and are possibly still increasing in Koshi as they are more adaptable to the widespread disturbance that Koshi faces and are known to flourish in such conditions. Pressure on lowland grasslands is increasing. Bengal Floricans are especially at risk during the monsoon when some move outside the protected areas where they might breed into unprotected riverine areas with adjacent agricultural fields.

![Table 4. Density of adult male Bengal Florican populations in southern and southeastern Asia.](attachment:table4.png)

Based on our studies and experience, we recommend that the local communities should be trained and supported in managing grasslands that fulfil their needs for cattle fodder and thatch grasses and provide suitable habitat for Bengal Floricans and other grassland species. Farmers should be encouraged to leave some of the grassland habitats within farmlands especially during Bengal Florican’s breeding season. This is already happening in Chitwan National Park buffer zone in East Nawalparasi District, where a community-managed grassland is working along similar lines to that of community forestry (Chitwan National Park 2016). Relevant national and local NGOs should buy and manage fallow-land and grassland areas along the Koshi River (and other major river courses in Nepal). Similar initiatives should be promoted in adjoining parts of India and establish transboundary cooperation to restore river habitat corridors facilitating bird movements. The Nepal Government should create and expand protected zones along river corridors.

The feral cattle and to some extent Wild Water Buffalo *Bubalus arnee* in Koshi Tappu have helped to keep the *Saccharum and Imperata* grasses short and suitable for Bengal Florican. This grazing needs to be monitored and regulated especially during the breeding season of birds, viz., April to August. Use of heavy machinery by Koshi Project, Government of Bihar, India should be avoided in Koshi Tappu especially during breeding season of Bengal Florican. This grazing needs to be monitored and regulated especially during the breeding season of birds, viz., April to August. Use of heavy machinery by Koshi Project, Government of Bihar, India should be avoided in Koshi Tappu especially during breeding season of April–August. Similarly, urgent action is needed to control the spread of invasive alien plant species, especially *Mikania micrantha* and *Parthenium hysterophorus*. Management with the aim to restore and/ or maintain
areas of intact grasslands should be implemented, based on improved understanding of floodplain grassland dynamics in Koshi Tappu Wildlife Reserve. Nationwide awareness programme should be conducted through audio-visual media such as documentaries on Bengal Florican as public support is crucial for the conservation of threatened species at the grass-root level.

REFERENCES


Electronic version accessed 4 December 2017.


Author details: Hem Sagar Baral studied ecology of grassland birds for his PhD from the University of Amsterdam, and has been involved in conservation for over three decades. He is the Country Representative of ZSL’s Nepal office. Tek Raj Bhatt is a senior programme officer for ZSL Nepal office. He is interested in conservation biology and has over 5 years of experience in biodiversity monitoring and research, development and implementation of conservation projects. Shyam Kumar Rai has an MSc in Environmental Science and has been working for ZSL Nepal office as a field biologist. His main interest is in wildlife ecology and has 5 years of experience in biodiversity monitoring and research. Ashok Kumar Ram is a conservation officer working for the Department of National Parks and Wildlife Conservation. Currently he is pursuing his PhD studies at the Wildlife Institute of India Dehradun on Asian Elephant ecology and movement. Shyam Kumar Rai has studied forest tree carbon stock for his MSc degree in Natural Resource Management from the University of Twente, the Netherlands. He has served as the Chief Conservation Officer at Koshi Tappu Wildlife Reserve. Currently he is the Management Officer at the Department of National Parks and Wildlife Conservation, Nepal. Lakshman Prasad Poudyal holds an MSc degree in Natural Resource Management and Rural Development. He has served as the Ecologist at the Department of National Parks and Wildlife Conservation, and currently is the Chief Conservation Officer at Shukhansanta National Park, Nepal. Dhirk Raj Chaudhary has been working as a bird guide for 10 years and has worked for various institutions in the past and has participated in the survey work under the aegis of Himalayan Nature, Gitanjali Bhattacharya is a conservation biologist specialising in integrated landscape management. Her past research has focussed on grassland and large herbivores. She has designed and led large-scale transboundary projects focussing on landscape connectivity working with a multitude of national and international partners including policymakers. She is currently the Head of Global Fundraising at Zoological Society of London and assists in the development of large-scale funding bids for landscape-wide projects. Rajan Amin is a senior wildlife biologist at the Zoological Society of London with over 30 years of experience in African and Asian grassland and forest ecosystems and in developing long-term conservation projects for threatened species.