The previous northern-most records from the bird's wintering range in the Western Ghats are from Goa, although rare (Baidya & Bhagat 2018). eBird shows three records, all from the Tambdi–Surla area in eastern Goa, near the Western Ghats range (eBird 2019). Hence, this appears to be the first documentation of this species from the state of Maharashtra.

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Some observations on duetting in the Greater Coucal *Centropus sinensis*

The Greater Coucal *Centropus sinensis* is widely distributed in the Indian Subcontinent, both in urban and rural settings, and its call is distinctive (Ali & Ripley 1969). The deep bass, sonorous '*whoop-whoop-whoop-whoop*…' call is instantly recognizable. Observations on the number of 'whoops' per call (from a few to 20–30), with a frequency of 2–3 whoops per second, have been well documented (Ali & Ripley 1969). Further, the vocal repertoire of the Greater Coucal is far wider than the classical '*whoop*', and up to eight distinct call types have been documented (Natarajan 1993).

Two interesting features of the Greater Coucal's vocalization are that both partners have a strong voice, contrary to what is generally assumed about a male's domination of avian vocalization, and that the male and female often coordinate their separate calls into a melodious 'duet' with intertwined notes. Hall (2009) describes duets as vocalizations that '…vary in form from loosely overlapping songs to highly coordinated duets where paired birds both adjust the timing and type of phrases they sing to fit those of their partner over the course of the duet. Duet coordination therefore signals how attentive an individual is to its partner, both to the partner and to other listeners.' Avian duetting is estimated to occur in about 18% of the world's bird population (Tobias et al. 2016). Ali & Ripley (1969) discuss the Greater Coucal's vocalization as, 'Usually in duets: as soon as one bird begins calling another within earshot (its mate?) almost invariably joins in.'

I present here some observations on the duetting characteristics of Greater Coucals.

To distinguish between normal calls/counter-calls of unattached birds and those of a bonded pair that duet, was a challenge. This was resolved by pure chance when a pair of bonded Greater Coucals took up residence in a green patch just above the fishing village of Odxel, on the northern bank of the Zuari River, Goa, just before it empties into the Arabian Sea.

Visual observations on the pair's movement and calling pattern indicated that the pair had a territory that extended for *c.*500 sq. m. Calls were heard mainly early in the morning, around a half hour before sunrise. They continued sporadically for one to two hours. Short vocalization spurts also occurred at dusk. A Zoom H1n portable recorder, with its built-in stereo X/Y 90˚microphones (96kHz, 24-bit), was used and timed to start at 0600 h for a period of up two hours. Recordings were analyzed using Adobe Audition CS5.5. On 29 January 2019, a clean recording was obtained from a short distance, which enabled this analysis. The total length of the original recording was 62 min with an excellent two-minute section at the 48th–50th minutes that contained both, single calls by both partners, and several duets. In order to determine whether these recordings were representative in relation to a wider spectrum of the species itself, a spectrographic analysis was made of the 55 Greater Coucal recordings from India on the global website www.xeno-canto.org. Of these, seven recordings contained duets (Table 1).

Table 1. India recordings of Greater Coucal judged to be duets on xeno-canto.org (Xeno-Canto)

XC Cat. No.	Recorder	Location	Date	Duration/min
XC 21128	Mascarenhas (2007)	Odxel, Goa	12 November 2007	0.24
XC 90405	Roy (2011)	Narendrapur, West Bengal	19 November 2011	0.47
XC 161204	Pinto (2012a)	Aldona, Goa	25 April 2012	0.57
XC 161234	Pinto (2012b)	Aldona, Goa	01 July 2012	1.27
XC 161236	Pinto (2012c)	Aldona, Goa	08 August 2012	1.16
XC 162834	Pinto (2012d)	Aldona, Goa	22 September 2012	2.08
XC 423656	Prabhu (2018)	Manipal, Udupi, Karnataka	04 July 2018	0.20

Call signatures: While male and female Greater Coucals are practically indistinguishable in both colour and size, it is clear that there are two distinct audio signatures (Fig. 1) from the pair. In this particular section, the calls were made sequentially, without the overlap one would attribute to a duet. One partner had a low frequency/low amplitude call (Frequency band: 188Hz to 565Hz) while the other, a high frequency/high amplitude call

(Frequency band: 282Hz to 658Hz), with average frequencies of 376Hz and 470Hz respectively in this specific sequence. In the absence of unequivocal gender evidence, simple labels were used, 'Hi-Fre/Hi-Amp' and 'Lo-Fre/Lo-Amp', to differentiate the partners. In the seven recordings from Xeno-Canto containing duets, these two distinct frequency/amplitude characteristics were found in each of them—a Lo-Fre/Lo-Amp (300-400Hz) partner and a Hi-Fre/Hi-Amp partner (400-500Hz) respectively.

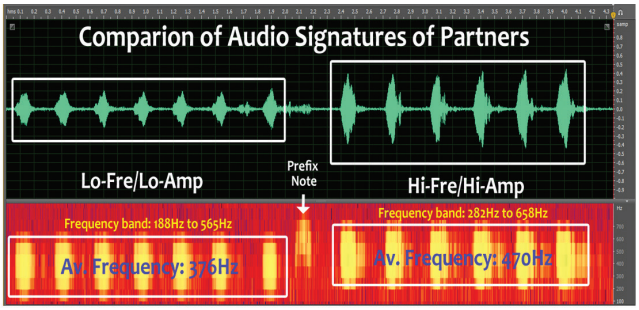

Fig. 1. Distinct acoustical signatures of this specific Greater Coucal partners

Length of calls and frequency of duets: Fig. 2 illustrates a one-and-a-half minute segment recorded with the pair. One of them starts the day with two to three soft and tentative '*whoops*' before both settle into their stride at six to eight '*whoop*' notes each. In the total of thirteen call sequences in this specific recording, only four were duets between both partners. Further, in a duet, total call sequences can be much longer: the longest recorded in this sequence comprised sixty-six '*whoops*' (D1); nearly eight–ten times the single caller norm of six to eight. However, a partner sometimes 'dips' in momentarily (D4) into a longer sequence of the other partner resulting in a short duet, which runs for only fifteen notes.

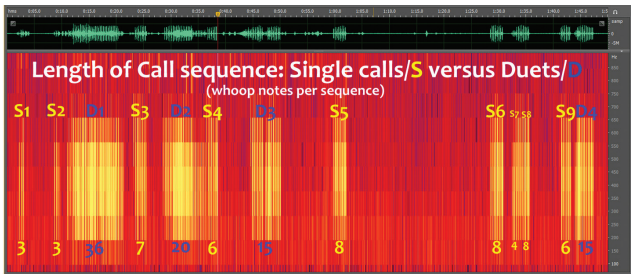

Fig. 2. Duet sequences (D) were observed to be longer than single caller sequences (S)

Joining the duet: The data in Fig. 3a suggests that either partner can join the other to start a duet. Nevertheless, in three of the four duets recorded in this sample, it was the Hi-Fre/Hi-Amp partner that joined in a call sequence already initiated by the Lo-Fre/Lo-Amp partner. In the seven recordings from the Xeno-Canto dataset that contained duets, the Hi-Fre/Hi-Amp partner joined the call sequence in nine of the seventeen duets recorded.

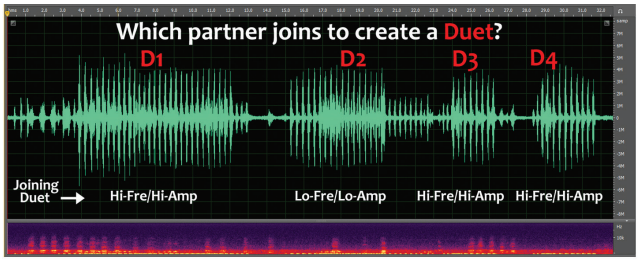

Fig. 3a: Duets are compared to analyze which partner decides to join in to create a duet.

Duet synchrony: Probably the most interesting aspect of the duetting phenomenon heard in these birds is the precision of the synchrony between the partners. Fig. 3b 'zooms-in' to look at Duet D2 and the way the second partner enters into an ongoing call sequence initiated earlier by the first partner. What is remarkable is the seeming ability of the second partner to time its entry precisely between the notes of the first and then maintaining that position. Presumably, any less precision would negate the power of the duet itself, that is, the benefit of projecting the power of two voices and not one. The same precision is seen in Duets one, three, and four as well as all the duets sampled from Xeno-Canto.

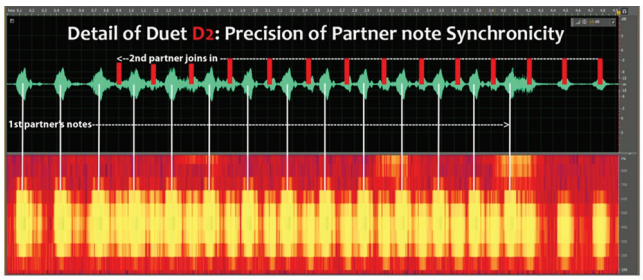

Fig. 3b: Degree of synchronicity of notes of second partner when joining to create the duet

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