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Short Note

Observed instances of alarm calling in the Cape Rockjumper

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Here I give an account of alarm calls recorded during behavioural observations on Cape Rockjumpers (CRJs) and the potential predators observed nearby. I found CRJs did not produce alarm calls in the presence of Boomslang (a previously known predator of CRJ nestlings), whereas they did produce alarm calls in the presence of Rock Kestrels, which was unexpected as previous literature suggested Rock Kestrels do not prey upon CRJ. However, during field observations I witnessed a Rock Kestrel attack an adult CRJ, suggesting that Rock Kestrels may opportunistically prey upon CRJs. Further studies on site- and temporal-specificity in CRJs may lead to additional understanding of the flexibility of alarm calling in group-living species.

Occurrences observées des cris d’alarme chez le Chétopse Bridé

Voici un rapport sur les cris d’alarme enregistrés lors d’observations comportementales chez le Chétopse Bridé, selon les prédateurs potentiels repérés dans les environs. Les Chétopses Bridés n’émettent pas de cri d’alarme en présence de Serpents des arbres (un prédateur connu des oisillons de cette espèce), bien qu’ils en émettent en présence de Crécerelles des rochers. Cela s’avère surprenant puisque de précédentes études suggèrent que les Crécerelles des rochers ne sont pas des prédateurs du Chétopse Bridé. Toutefois, au cours d’ observations sur le terrain, j’ai pu observer une attaque de Crécerelle des rochers sur un Chétopse Bridé adulte, suggérant que ces derniers pourraient opportunément prédater le Chétopse Bridé. Des études complémentaires sur les spécificités temporelles et spatiales du Chétopse Bridé pourraient mener à une meilleure compréhension de la flexibilité des cris d’alarme chez les oiseaux vivant en groupes.

Keywords: alarm calling, Cape Rockjumper, sentinel behaviour

Alarm calls are given by animals in the presence of predators, generally classified as ‘mobbing’ alarm calls that alert nearby individuals to harass stationary or terrestrial predators, or ‘fleeing’ alarm calls (discussed herein) that warn others to find cover from hunting aerial predators (Seyfarth et al. 1980; Bradbury and Vehrencamp 1998; Leavesley and Magrath 2005; Fallow and Magrath 2010). Alarm calls can positively influence the survival of nearby individuals (preferably kin or mates) by alerting them to danger. Alarm calls can also result in increased attention from predators (Bayly and Evans 2003), decreasing foraging time and increasing predation risk due to exposure of the sentinel (Lima 1987; Fritz et al. 2002).

Birds may not always signal perfectly, and occasionally calls may be mismatched (i.e. call type may not match the predator type) or give false alarms (Gyger et al. 1987; Gill and Sealy 2003). Although some studies have shown that deceptive calls or false alarms may have benefits to the caller when deceiving other species (Flower 2011; Flower, et al. 2014), mismatched calls may increase mortality, while species with large proportions of false alarms waste time and energy (Gill and Sealy 2003; Gill and Bierema 2013). This suggests mismatched calls and false alarms should be relatively rare, though further research is needed given the large proportion of false alarms reported in some species (Beauchamp and Ruxton 2007). The costs of alarm calling increase when alarm calls require extended time to produce, leading to increased exposure and risk of predation to callers, although in some cases the urgency of the threat may be greater than the potential risk (e.g. Superb Fairy-wrens *Malurus cyaneus*; Fallow and Magrath 2010).

Sentinels in groups are generally able to provide accurate information on predation risk as they tend to move to higher elevation to act as look-outs (Bednekoff and Lima 1998; Ridley et al. 2013). This grouping may partially mitigate the costs of alarm calling, allowing group members to invest less time on vigilance (Beauchamp and Ruxton 2007), and benefiting total fitness when individuals of the group are related. If the sentinel can provide updated and accurate information about predation risk, other group members may continue foraging without compromising safety or foraging success rate (Bell et al. 2009).

Here I report observations of alarm calls collected over four months of observations on the group-living Cape Rockjumper *Chaetops frenatus* (CRJ) as part of a study examining their physiology and behaviour. Previous literature on the breeding biology of CRJs indicated their main predators included Yellow Mongoose *Cynictis penicillata*, Cape Grey Mongoose *Galerella pulverulenta*, White-necked Ravens *Corvus abicollis*, Chacma Baboons *Papio ursinus* and several large snakes including Boomslang *Dispholidus typhus* and Cape Cobras *Naja nivea* (Holmes et al. 2002). I therefore expected most instances of CRJ alarm calling to be in conjunction with the presence of these predators, as they all occur at the present study site. As CRJs are facultative cooperative breeders that live in well-defined territories in groups of two to five individuals, I also expected to find shared group vigilance (Holmes et al. 2002).

Data were collected on five CRJ family groups between 24 January and 21 April 2015 at Blue Hill Nature Reserve (BHNR), Western Cape, South Africa. BHNR (33.59° S, 23.41° E) consists mainly of mountain fynbos, the preferred habitat for CRJs. For this study I followed two groups of five CRJs (each with two females and three males) and three pairs of two CRJs (consisting of one female and one male) using two to three observers for data collection. Family groups were located using a VHF transmitter tag (BioTrak CTx; frequency of ~150 MHz) placed on one individual per family, with each tag set to transmit one day per 12-day cycle. Data were recorded from pre-dawn until 18:00 on one family group per day. Scan samples were conducted at 5 min intervals for all individuals in view, with environmental, individual and behavioural variables recorded. Alarm calls were recorded on a presence/absence scale; if an alarm call was given we scanned for any predators visible in the vicinity, and if a predator was observed, the identity of the predator was recorded.

We observed 36 instances of alarm calling in total over 408 h of observations (6 323 samples). In 19 of these instances we could not determine a nearby predator. In the remaining 17 instances the following potential predators were associated with alarm calls: one Black Harrier *Circus maurus*, one Jackal Buzzard *Buteo rufofuscus*, three Cape Grey Mongoose, five human observers, and seven Rock Kestrels *Falco rupicolus* (Figure 1). Sex ratio for the total number of calls given varied among families; in two pairs only the males gave alarm calls, in one pair the male gave 33% of alarm calls, and group males gave 67% and 33% of alarm calls (Figure 2). The number of calls recorded increased as the size of the family group increased; pairs gave between three and five calls, whereas groups gave between seven and 18 calls (Figure 3).

I observed no obvious sexual dimorphism in individuals who gave alarm calls, although males did produce more calls overall (65.71%). It is possible that in pairs the males are more likely to act as sentinel. In support of the latter argument, I observed that only males gave alarm calls in two of the three pairs, whereas in the third pair the male and female each called once (a third call was given by this pair, but its origin could not be determined). Nonetheless sample sizes are too small to draw firm conclusions. A previous study on CRJs found similar results in that all individuals of family groups were noticed giving alarm calls in the presence of Chacma Baboons and human observers (Holmes et al. 2002). The average number of calls per individual does not appear different relative to group size as on average pairs gave 1.83 calls individual^{-1}, whereas groups gave 2.5 calls individual^{-1}. The slightly higher call rate in groups suggests a possible benefit to CRJs in larger groups, but the lower number in pairs may be due to smaller territories, with less territory visited during the day resulting in less predators encountered, and again a larger sample size is needed to verify if the difference is significant.

It was unclear which individuals were dominant in the CRJ family groups, and whether dominant individuals were more likely to produce calls. However, I observed that at least four of the five individuals gave at least one call when in groups (Figure 3). Individuals who called more often may be dominant, as Zahavi and Zahavi (1997) suggested there might be additional benefits to individuals acting as sentinels, and risks associated with being exposed lead to sentinel

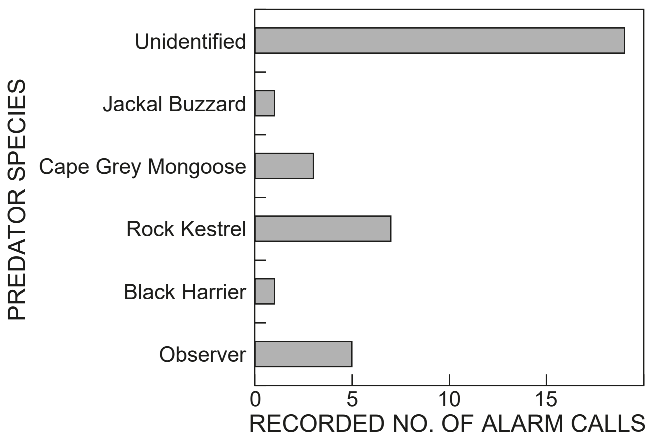

Figure 1: Recorded number of alarm calls given by Cape Rockjumpers *Chaetops frenatus* in the presence of nearby predators over 25 d of observation at Blue Hill Nature Reserve, Western Cape, South Africa

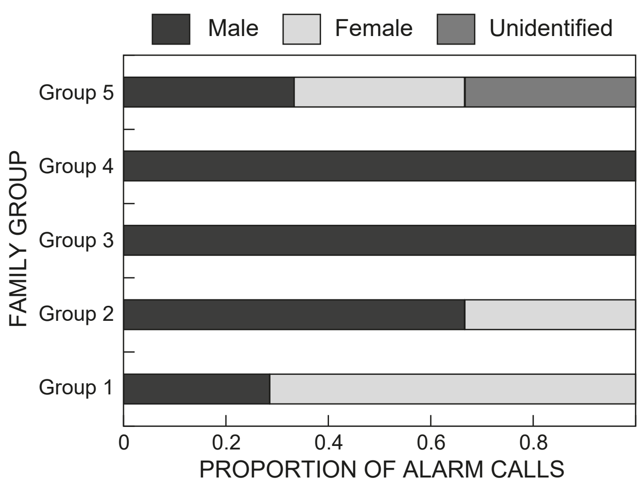

Figure 2: Proportion of alarm calls given by male and female Cape Rockjumpers *Chaetops frenatus* from five different family groups of either five members (groups 1 and 2; consisting of three males and two females) or pairs (groups 3, 4 and 5; consisting of one male and one female) over 25 d of observation (five days per family) at Blue Hill Nature Reserve, Western Cape, South Africa

behaviour becoming a handicap signal amongst more fit individuals. In addition, it is possible that CRJ alarm call components vary depending on the type of predator present as calls were between one to three notes long. Studies on both Vervet Monkeys (Seyfarth et al. 1980) and chickens (Gyger et al. 1987; Evans et al. 1993) found the type of alarm call produced was highly dependent on the type of predator. Although alarm calls varied in number of notes, there was no discernible difference in overall structure.

It was expected that there would be more alarm calls in general than was observed, as there were only 36 scan samples with instances of alarm calls recorded during 25 d of observation that resulted in 6 323 total scan samples. A higher rate of alarm calling when an aerial predator or snake was in the vicinity was also expected, as they were the most commonly observed potential predators. Although mongoose were in the area, they were often at lower altitudes less frequented by CRJs. Similar to Superb Fairy-wrens (Fallow and Magrath 2010), CRJs may be vulnerable to aerial attack due to their common occurrence in open areas. Interestingly, while both Cape Cobras and Boomslang are prevalent at BHNR, on two separate occasions CRJ were seen foraging within view of adult Boomslang (one instance at ~5 m and one at ~20 m), and on neither occasion did they give an alarm call despite being well within view. This suggests that Boomslang may not be perceived as predators of adult CRJs, although they have been known to depredate nests (Holmes et al. 2002), and so it is possible that CRJ would alarm call them during the breeding season.

Despite literature suggesting Rock Kestrels are not predators of CRJs, they were the most frequent predators nearby when CRJs alarm called. In general, Rock Kestrels feed on large orthopterans, as well as small rodents and lizards (King and Cowlishaw 2009). Rock Kestrels were not recorded as potential predators of CRJs in a previous study on CRJ breeding biology (Holmes et al. 2002), despite their relatively high reporting rate at that study site (40.54–55.00%, SABAP 2). The size of the average CRJ (~55 g) makes it just over one-third of the size of the average Rock Kestrel (~160 g), and so a surprisingly large prey item for the relatively small bird of prey.

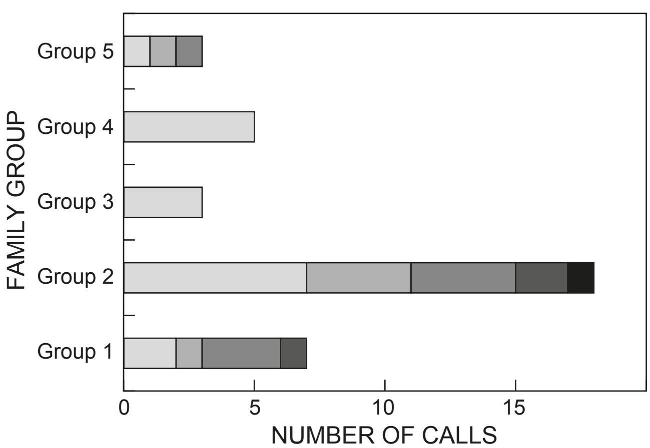

Figure 3: Number of calls given by Cape Rockjumpers *Chaetops frenatus* from five different family groups of either five members (groups 1 and 2; consisting of three males and two females) or pairs (groups 3, 4 and 5; consisting of one male and one female) over 25 d of observation (five days per family) at Blue Hill Nature Reserve, Western Cape, South Africa. Shades of grey indicate separate individuals

Given the size difference and past literature I initially assumed CRJ alarm calls in the presence of Rock Kestrels were a case of mistaken identity. It seemed possible that CRJs were mistaking Rock Kestrels for Rufous-chested Sparrowhawks *Accipiter rufiventris*, a far more likely predator of CRJs that was recorded preying on Drakensberg Rockjumpers *Chaetops aurantia*, the nearest relation of the CRJ (Roberts 1966). However, after witnessing an attack on a CRJ by a Rock Kestrel on 7 September 2015 (Lee and Oswald 2015) it became clear that Rock Kestrels will indeed prey on CRJ if the opportunity presents itself. In the case of Lee and Oswald (2015), the attack occurred on a CRJ that had been caught in a spring trap (a spring-loaded frame covered in thin net that shuts when the trigger mechanism is activated) baited with mealworms, and so may have represented a rare opportunity for the Rock Kestrel. However, the relatively high abundance of Rock Kestrels at our field site and low observed abundance of Rufous-chested Sparrowhawks (one instance observed; no data available for this site from SABAP 2) suggests that it is not a case of mistaken identity but that CRJs perceive Rock Kestrels as a threat.

Alarm calling may not only depend on the specific predator abundance in any given site, but also on the time of year. All data recorded for this study were collected in the non-breeding season, whereas the previous study in which Rock Kestrels were not mentioned as a predator occurred during the breeding season (Holmes et al. 2002). The degree of stimuli (i.e. urgency level of a perceived threat) necessary for a CRJ to alarm call may be lower during breeding, and as all of the data presented here were collected during the non-breeding season, it would be interesting to see any change if a similar study were to occur at BHNR during the breeding season.

In conclusion, although there is still little data on CRJs, it is possible that the observed phenomenon of alarm calling at Rock Kestrels, while not alarm calling at Boomslang, was not mistaken identity on the part of CRJs. Given that studies have found it costly to produce mismatched calls or false alarms, and the relative scarcity of CRJ alarm calling in general, it seems unlikely that CRJ are prone to giving either mismatched calls or false alarms. CRJs may be more likely to alarm call at Boomslang when breeding, and the abundance of Rock Kestrels present may have led to them being viewed as predators in this specific site at this specific time. Further examination is needed to determine if what was observed in this study is a regular occurrence, or if the observed phenomena were site- or temporal- specific.

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