

## Breeding season of the Endangered White (Umbrella) Cockatoo, and possible competition for nest holes with Blyth's (Papuan) Hornbill in North Maluku, Indonesia

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**Summary:** The White Cockatoo *Cacatua alba* is endemic to the North Molucca islands and is considered Endangered mostly due to unsustainable levels of trapping for the pet trade. Little is known about its breeding biology in the wild, except that it nests in tall trees during the early part of the year. We made brief observations of two active nests of White Cockatoos on Halmahera and another on Ternate in February and March 2014, and estimate the egg laying dates of two of these nests as mid-October and mid-November. Combined with other data, the breeding season appears to extend from October to May or June. All three nests were visited by Blyth's Hornbills *Rhyticeros plicatus*, a species which occurs throughout North Maluku, as well as New Guinea. One nest was subsequently abandoned. In September and November 2014, we observed two active nest cavities of hornbills, one of which was inspected by a cockatoo, and the other, approached closely by cockatoos. Both hornbill nests were reported to have been used previously by White Cockatoos, suggesting that the two species may either share or compete for the same nest cavities. Sharing of cavities may be facilitated by partly non-overlapping breeding seasons, as Blyth's Hornbill reportedly lays eggs from August to October in the region. However, as the nest cycle of both species is c.4 months, it is possible that early nesting pairs of one species may attempt to usurp nest cavities occupied by the other species. The potential for nest competition may be exacerbated on small islands where deforestation has reduced the number of nest cavities available for hole-nesting species.

**Ringkasan:** Kakatua putih *Cacatua alba* adalah spesies endemis di kepulauan Maluku Utara dan berstatus Genting yang diakibatkan karena tingginya tingkat penangkapan dan perdagangan. Hanya sedikit yang diketahui tentang biologi perkembangbiakan Kakatua putih di alam, kecuali bahwa spesies ini bersarang di pohon-pohon tinggi selama awal tahun. Kami mengamati dua sarang Kakatua Putih yang aktif di pulau Halmahera dan di pulau Ternate pada bulan Februari dan Maret 2014, dan memperkirakan tanggal bertelurnya Kakatua putih di dua sarang ini pada pertengahan Oktober dan pertengahan November. Dikombinasikan dengan data lain, musim bertelur tampaknya berlangsung dari Oktober hingga Mei. Ketiga sarang tersebut juga dikunjungi oleh Julang irian *Rhyticeros plicatus*, spesies yang tersebar di seluruh Maluku Utara, serta Papua. Satu sarang kemudian ditinggalkan. Pada September dan November 2014, kami mengamati dua lubang sarang Julang irian yang masih aktif, satunya diperiksa, dan yang satunya lagi, hanya didekati dari jarak dekat oleh Kakatua putih. Kedua sarang dilaporkan telah digunakan sebelumnya oleh Kakatua putih, yang menunjukkan kedua spesies dapat berkompetisi untuk lubang sarang yang sama, atau keduanya bisa berbagi lubang sarang di waktu yang berbeda, seperti Julang irian yang dilaporkan bertelur dari Agustus hingga Oktober. Namun, karena siklus sarang kedua spesies selama 4 bulan, pasangan bersarang pada tahap awal dari satu spesies dapat mencoba untuk merebut lubang sarang spesies lain. Potensi kompetisi lubang sarang dapat diperburuk di area dimana deforestasi mengurangi jumlah lubang sarang yang tersedia.

## Introduction

The White or Umbrella Cockatoo *Cacatua alba* is a large cockatoo (body length, 46cm; weight, 550g) endemic to the islands of North Molucca, namely Halmahera, Bacan, Ternate, Tidore, Kasiruta and Mandiole (Rowley & Boesman 2018). It inhabits both primary and logged forest, and their edges, from sea level to 900 m asl, but mostly less than 300 m asl (Lambert 1993; Poulsen & Lambert 2000). This species is now listed as Endangered (CITES II, IUCN) due to habitat loss and hunting for the pet trade. Forest exploitation by logging companies has become intensive, and some areas have been cleared for agriculture and mining (Birdlife International 2017). The White Cockatoo has long been popular among aviculturists (Smiet 1985). From 1983 to 1993, it was the most heavily traded parrot species in Indonesia, with an average annual export of 4,533 birds, though from 1994 to 1999 it dropped to ninth place (Soehartono & Mardiasuti 2002). Nevertheless in 2007, at least 200 White Cockatoos were caught from the wild in north Halmahera, far exceeding the catch quota of 10 pairs (ProFauna 2008). During 2010-2012 at least 1,152 individuals were caught from the wild in Halmahera (Rosyadi 2015), and during June 2018, 18 wild-caught cockatoos were rescued by police in South Halmahera (ProFauna 2018).

Despite its unwanted popularity, very little is known about the breeding biology of the White Cockatoo. Based largely on information from local trappers and villagers, Lambert (1993) concluded that it nests in cavities in very tall trees, and that the breeding season begins during the early part of the year. All cockatoos and the vast majority of parrots nest in tree cavities, which are often limited in their availability (Heinsohn *et al.* 2003; Legge *et al.* 2004; Renton *et al.* 2015), particularly where deforestation has occurred (Marsden & Pilgrim 2003). Thus there is great potential for competition between them and with other cavity-nesters. Indeed, on the island of Sumba in the Lesser Sundas, nearly half of the 122 parrot nests found were in trees containing other parrot nests, one tree containing no fewer than five nests (Marsden & Jones 1997). Similarly, almost half of the cavities visited by the Critically Endangered Citron-crested Cockatoo *C. (sulphurea) citrinocristata* attracted interest by other cavity-nesting species or were in trees that contained another potentially active cavity (Walker *et al.* 2005).

In this report we document five cases of possible competition for nest cavities between White Cockatoos and the Blyth's or Papuan Hornbill *Rhyticeros plicatus*, a species which is distributed widely from North Moluccas through New Guinea to the Solomon Islands (Kemp & Kirwan 2018). Despite this wide distribution, the breeding biology of this species in the wild is poorly known, but it is said to lay eggs from August to October in western parts of its range. Given that the breeding season of White Cockatoos allegedly starts in the early part of the year, we might expect there to be little direct competition for nesting cavities, and thus few interactions at nests. However our observations suggest that the cockatoo starts breeding earlier than previously reported.

## Observations

Between February and November 2014 we observed interactions between Blyth's Hornbills and White Cockatoos at nest cavities in five localities on Halmahera and Ternate island. These observations are detailed below.

On Tutuling Jaya, eastern Halmahera, the first and fourth authors (hereafter IR and MA, respectively) observed a nest of White Cockatoos in Mou-Mou forest, 4 km from Oboy village, on 3 February 2014 (Plate 1). This nest was occupied by two chicks, but at 14:00 hrs one of the chicks left the nest tree with its parents, while the second chick stayed in the nest, its head visible at the entrance. A few minutes later a female Blyth's Hornbill flew to the broken branch

1.0m under the nest entrance and observed the cockatoo chick for a minute then flew off. During this time the cockatoo chick retreated into the nest, avoiding contact with the hornbill.

In Aketajawe National Park, c.4 km from Binagara village, eastern Halmahera, we observed another nest of cockatoos, attended by three birds, possibly two adults with one fledgling, in a Matoa tree (*Pometia* sp) in primary forest on 26 February 2014 (Plate 2). On 13 April, IR and MA noticed the nest was no longer active but in the evening at 17:55 hrs saw a male Blyth's Hornbill approaching the nest. The hornbill perched at the entrance, inspected the nest hole for a few seconds and then flew off (Plate 3).



**Plate 1.** White Cockatoo at nest, Mou-Mou Forest, Halmahera, 3 February 2014 (all photographs by Irfan Rosyadi)



**Plate 2.** Cockatoos at nest, Aketajawe National Park, Halmahera 26 February 2014.



**Plate 2.** Blyth's Hornbill inspecting the same nest hole, 3 April 2014.

At Tolire Lake, Ternate, IR and MA observed a cockatoo perched on a branch, apparently guarding its mate which stayed inside a hole in a tree next to a cliff at 10:00 hrs on 8 March 2014 (Plate 4). At 15:00 hrs on 22 March a female Blyth's Hornbill was observed at the cockatoo's nest, extending her bill into the nest hole (Plate 5), while the cockatoo remained inside the nest. After c.5s, the hornbill flew off and left the nest tree. Subsequently, according to a local guide, activity ceased at this nest cavity, the cockatoo apparently abandoning its nest.

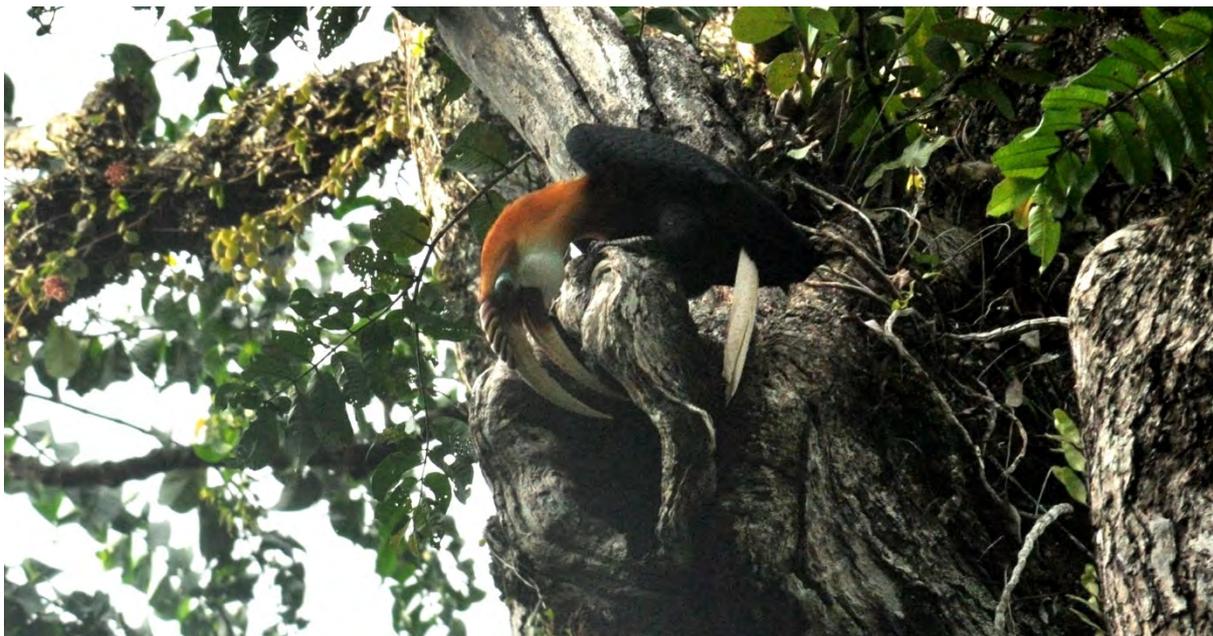


**Plate 4.** Cockatoos at nest hole, Tolire Lake, Ternate, 8 March 2014



**Plate 5.** Female Blyth's Hornbill inspecting same nest hole on 22 March 2014.

At Kowejeno forest near Foli village, Halmahera, IR and MA observed a male Blyth's Hornbill provisioning his mate at the nest on 3 September 2014 (Plate 6). According to a local villager in Oboy, this hole was used for nesting by White Cockatoos in January of the same year. The nest tree was identified as *Duabanga moluccana*. At 15.00 hrs the male Hornbill brought fruit for the female which was known to be inside the nest. In the evening before dusk four White Cockatoos flew into a large fig tree c.100 m from the hornbill's nest-hole. After a few minutes the cockatoos flew towards the hornbill's nest, while calling loudly. At the same time, however, we heard the male hornbill calling out loudly, and the cockatoos apparently reacted by flying past the nest tree, eventually perching some distance away from the nest tree. Just after dusk the cockatoos returned and perched on a *Bugis* tree that was located close to their first perch on the fig tree, this time c.60m from the nest tree.



**Plate 6.** male Blyth's Hornbill provisioning his mate at the nest, Kowejeno Forest, Halmahera, 3 September 2014



**Plate 7.** Cockatoos roosting alongside Blyth's Hornbill nest, Oboy, Halmahera, 24 November 2014.



**Plate 8.** Blyth's Hornbill provisioning same nest, 25 November 2014.

During 23-25 November 2014, IR and MA watched another nest of Blyth's Hornbills in Oboy, which, according to locals, was previously used by White Cockatoos for nesting. The male hornbill visited the nest twice each day (at around 09:00 and 17:00 hrs) to feed the female which was presumably incubating its egg(s). About eight cockatoos roosted in the nest tree (*Pometia* sp) each night, arriving gradually from 16:00hrs to 18:00 hrs or later. In the morning they began calling at 06:00 hrs and individuals in the group left the nest tree gradually. At 09:09 hrs on 23 November one cockatoo landed beside the hornbill's nest entrance and inspected the nest for about 4 min. In the evening on the same day, eight cockatoos landed in the nest tree but at 18:23 hrs the male hornbill arrived with fruit in its bill and chased the cockatoos away. After all of the cockatoos left the tree, the male hornbill also left. On the following day, at 17:45 hrs the male hornbill arrived with fruit to feed the female inside the nest. Ten minutes later, the male hornbill left the nest tree, and the cockatoos arrived one by one to take up their roosting positions (Plate 7). The male hornbill did not return to the nest tree during that evening, but on the following day (25 November) it visited the nest tree at 09:11 hrs (Plate 8).

## Discussion

### *Cockatoo-hornbill interactions*

Intraspecific and interspecific competition for nest holes is common among cavity-nesting birds, especially parrots, due to the limited availability of suitable cavities (Brightsmith 2005; Renton *et al.* 2015). At Iron Range National Park in the tropical northeast of Australia, Heinsohn *et al.* (2003) found intense competition for nest holes among Eclectus Parrots *Eclectus roratus*, Palm Cockatoos *Probosciger aterrimus* and Sulphur-crested Cockatoos *C. galerita*. Like cockatoos and parrots, hornbills are secondary cavity-nesters, unable to excavate their own nest holes. Thirteen species of hornbills are found in Indonesia (Eaton *et al.* 2016), but only four occur east of Wallace's Line. The vast majority of cockatoo species, on the other hand, are found east of Wallace's Line, so few species overlap in their range with hornbills. Exceptions include the Critically Endangered Yellow-crested Cockatoo *C. sulphurea* which overlaps with the two endemic hornbill species on Sulawesi, and with the endemic Sumba Hornbill *Rhyticeros everetti* on Sumba. The range of the Critically Endangered Philippine Cockatoo *C. haematuropygia* also overlaps broadly with hornbills, of which there are ten Philippine-endemic species.

Of 24 potentially active nest cavities of the Citron-crested Cockatoo *C. s. citrinocristata* found by Walker *et al.* (2005) on Sumba, eleven were in trees that were visited or occupied by

other hole-nesting species. One pair of cockatoos attempted to usurp the nest cavity of a pair of Sumba Hornbills (Walker *et al.* 2005: Table 3). Our observations suggest a higher frequency of interactions between cockatoos and hornbills on Halmahera and Ternate than on Sumba, as interactions occurred at all five nests watched. All three White Cockatoo nests were inspected by Blyth's Hornbills, and one was subsequently abandoned, though it is not known whether this was caused by the hornbills. In addition, both active nest cavities of Blyth's Hornbills were reported to have been occupied previously by White Cockatoos, and one was inspected by a cockatoo, which was apparently chased away. As Blyth's Hornbills are much larger (body length, 65–85cm) and heavier (1.2–2.0 Kg) than White Cockatoos, we would expect them to be dominant in interspecific contests.

Marsden & Pilgrim (2003) concluded that there was a shortage of suitable nest-sites for the ten species of parrots and Blyth's Hornbill on New Britain, PNG, with estimates of 10–20 parrot/hornbill individuals per potential nest cavity. They thought it was unlikely that the breeding seasons of parrots and hornbills on New Britain differed sufficiently between species to allow nest cavities to be used by more than one pair of birds in a given year. However, our observations of White Cockatoos and Blyth's Hornbills on Halmahera and Ternate imply that these two species could indeed share nest cavities by breeding at different times of the year.

### ***Breeding seasons***

Little is known about the breeding season of the White Cockatoo. On Bacan, Lambert (1993) observed two probable nest-sites of cockatoos in October and November 1991, and found a young captive cockatoo that was probably taken from the nest in March or April. Smiet (1985) observed several “breeding pairs” on Bacan in April 1981. On Halmahera, trappers had a young bird taken from a nest in a *Canarium* tree in August, while villagers claimed that cockatoo nests contained eggs in May (Lambert 1993; Collar *et al.* 2001). Observations of captive birds suggest that the eggs are incubated for c.4 weeks, and the young remain in the nest for a further c.14 weeks (Rowley & Boesman 2018). Incubation periods of Australian cockatoos of a similar or larger body length and/or weight to the White Cockatoo are 28–33 days (Higgins 1999; Murphy *et al.* 2003), and therefore concordant with that of the latter species. Nestling periods of large Australian cockatoos are typically 10–12 weeks, but up to 90 days, and rarely 100 days, in black cockatoos of the genus *Calyptorhynchus* (Higgins 1999; Murphy *et al.* 2003). However, black cockatoos are on average, c.30% larger and heavier than the White Cockatoo (data from Higgins 1999). Therefore, the alleged 14-week nestling period of the White Cockatoo is either atypically long for its size, or is, as we believe more likely, anomalous due to the artificial feeding regime of the captive birds on which it is based.

Notwithstanding uncertainty about the duration of the nestling period, assuming that the nestlings taken on Bacan and Halmahera (Lambert 1993) were at least half-grown (c.7 weeks), they probably hatched from eggs laid in January or February and June, respectively. Combined with reports of eggs or “breeding” in April and May, this suggests an egg-laying season comprising the first five months of the year. The report of a cockatoo nest in January at Kowejeno forest near Foli village, and the active nest at Tolire Lake on Ternate, are consistent with that season. However, our observations on Halmahera indicate that the breeding season starts before January. As one or more of the young from the nest at Tutuling Jaya fledged on 3 February, the eggs in this nest were probably laid by mid-October. Assuming the third bird at the nest at Aketajawe National Park was a fledgling, it most likely came from an egg laid in early to mid-November. Thus, Lambert's (1993) observations of “probable nest-sites” in October and November on Bacan may well represent actual breeding records.

The Blyth's Hornbill is known to lay eggs from about August to October in the western parts of its range, which include the North Molucca islands (Kemp & Kirwan 2018). Studies of birds in captivity indicate the whole nesting cycle is c.125 days (or 18 weeks), which is remarkably similar to that of the White Cockatoo (see above). Our hornbill nest at Kowejeno forest was active in early September, and whilst the stage of development is unknown, the eggs were most likely laid between late May and late August. Assuming there were eggs in the second hornbill nest (in late November), they were probably laid in October or early November. These dates are consistent with the reported breeding season for the species, and suggest that late nests overlap with early nests of the White Cockatoo, i.e. in October and November.

Conversely, cockatoo nests started after December might be expected to avoid potential usurpation by hornbills. Although the cockatoo nest at Tolire Lake was reportedly abandoned soon after we had seen a hornbill inspecting it, we have no direct evidence of the latter usurping the nest. Similarly, whilst the cockatoo nests on Halmahera were inspected by hornbills in February, the reported breeding season of the latter suggests that such visits were not serious attempts to usurp the nest.

### Conclusions

The Blyth's Hornbill occurs throughout the restricted range of the White Cockatoo. Our observations indicate that interactions between these species at nest cavities are common, but whether these instances represent attempts by individuals of one species to usurp individuals of the other is unknown. As we did not undertake a survey of potential or actual nest cavities, we do not know if they are in short supply or not. Limited availability of suitable nest-holes could lead to interspecific competition, especially at times when the breeding seasons of the two species overlap. Potential competition for nest holes probably has more implications for the conservation of White Cockatoos on the smaller islands in its geographical range. According to Vetter (2009) habitat loss over the next three generations of White Cockatoos is expected to be over 65%. Although both species tolerate some habitat modification (Lambert 1993; Marsden & Pilgrim 2003), they are dependent on the continued availability of large trees with cavities for successful breeding. Until now, the White Cockatoo has also suffered unsustainable levels of trapping for the pet trade (ProFauna 2008, 2018; Rosyardi 2015), but a new Indonesian government regulation (Environment and Forestry Minister's Decree no. P.92/MENLHK/SETJEN/KUM.1/8/2018) offers hope for its protection from this longstanding threat.

### Acknowledgements

The observations in this study were the result in part of Burung Indonesia's project which was funded by Zoologischen Gesellschaft für Arten und Populationsschutz e.V. (ZGAP). We wish to record our utmost gratitude to Pak Kristian, Pak Ferdinand and Pak Kadus Oboy who assisted us during nest and nest tree observations in Halmahera, and Hafid Hamid who guided us to Tolire Lake in Ternate. Many thanks go to Burung Indonesia staff in Halmahera, Grace Ellen and Reno Arief, who helped in all the preparations. Our thanks also go to Aketajawe Lolobata National Park authority for the permit to conduct surveys in the National Park. We are also very grateful to Stuart Marsden, Mike Chong, and Colin Trainor for their valuable comments on earlier versions of this paper, and Nick Brickle for his help with the final editing.

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