

Biology and conservation of Pink-headed Fruit-dove *Ptilinopus porphyreus*

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Summary

Pink-headed Fruit-dove *Ptilinopus porphyreus* is a little-known, restricted-range species, endemic to the mountains of the Indonesian islands of Sumatra, Java and Bali. In the period 1981–2002 we conducted surveys throughout its range and compiled data on its presence and absence on 32 isolated mountain complexes. The fruit-dove appeared to be restricted to < 12,000 km² of forest, scattered over 20 major mountain complexes on the three islands, i.e. three on Sumatra, 16 on Java and one on Bali. It occurred exclusively on mountains of > 2,000 m in altitude, where, depending on the size of the mountain, it reached its lower altitudinal limit between 500 and 1,000 m. The species was found mostly in singles or as pairs but occasionally in flocks of up to 17 individuals. It occurred almost exclusively in forest, feeding on figs and small berries in the upper-canopy. We documented three cases of breeding in the wild. From captive birds it is known that a single egg is laid which is incubated for 20 days, with fledging occurring after another 15–16 days. Based on a study of 104 skins, the breeding season peak in West Java is at the beginning of the dry season. Although Pink-headed Fruit-dove is found in scattered, ever-shrinking forest blocks of mostly < 200 km², the scarcity of recent field records is more than likely due to its inconspicuous behaviour, and a threatened status is unwarranted as yet.

Ringkasan

Walik kepala-ungu *Ptilinopus porphyreus* adalah jenis Burung Sebaran Terbatas yang hanya sedikit dikenali. Jenis ini adalah endemik di pegunungan pulau Sumatera, Jawa dan Bali. Selama tahun 1981–2002 kami melakukan survei di seluruh daerah penyebarannya dan mengumpulkan data mengenai keberadaan jenis ini di 32 kompleks gunung yang terpisah. Penyebarannya adalah terbatas pada areal hutan dengan luas keseluruhan kurang dari 12,000 km², tersebar di antara 20 kompleks gunung utama di ketiga pulau tersebut, yaitu tiga di Sumatera, 16 di Jawa, dan satu di Bali. Walik ini hanya terdapat di gunung yang tinggi lebih dari 2000 m, di mana ketinggian terendahnya adalah antara 500 dan 1000 m, tergantung pada ukuran gunung yang bersangkutan. Jenis ini paling sering ditemukan berpasang atau sebagai individu, tetapi kadang-kadang berkumpul sampai 17 ekor. Hampir selalu terdapat di dalam hutan, memakan buah ara dan buah kecil lain di tajuk pohon. Kami laporkan tiga kasus berbiak dari alam, sedangkan dari penangkaran kami ketahui bahwa biasanya telur sebutir dierami selama 20 hari, dan anaknya meninggalkan sarang pada umur 15–16 hari. Berdasarkan penelitian terhadap 104 spesimen yang berasal dari Jawa Barat, puncak musim berbiak mulai pada awal musim kemarau. Jenis walik ini terbatas pada kantung hutan yang kebanyakan kurang dari 200 km² luasnya, yang terpotong-potong serta menciut terus-menerus. Walaupun demikian pengamatan baru dari lapangan yang sangat sedikit itu kemungkinan besar disebabkan perilakunya yang tidak menonjol. Maka statusnya sebagai jenis terancam punah belum pantas diberikan.

Introduction

Unlike in many other tropical regions, large-scale deforestation on Java, Bali and, to a lesser extent, southern Sumatra dates back several centuries (Whitten *et al.* 1996, 2000). In effect most of the lowland forest < 1,000 m altitude has been replaced by a mosaic of cities and villages, agricultural land, cash-crop plantations and forest estates. Remaining forest is mostly found only on the (higher) slopes of the many volcanoes that are scattered across these islands. As a result, forest-dependent birds are fragmented into numerous (small) isolated populations. One of these birds is the little-known Pink-headed (or Pink-necked)¹ Fruit-dove *Ptilinopus porphyreus*. Endemic to Indonesia, it is found only in mountain forests of Java, Bali and southern Sumatra (van Marle and Voous 1988, MacKinnon *et al.* 1999). It is classified as a restricted-range species, i.e. its breeding range is < 50,000 km², and the species occurs in two Endemic Bird Areas: Java and Bali Forests, and Sumatra–peninsular Malaysia (Stattersfield *et al.* 1998).

Very little information is available on the general biology of Pink-headed Fruit-dove (Goodwin 1983, Baptista 1997, Gibbs *et al.* 2001). In its montane forest habitat the species is generally uncommon and seldom seen, as it is quiet and inconspicuous (Gibbs *et al.* 2001). So far only a single breeding record has been published (van Balen and Marhadi 1989). Very little is known about the species' status and conservation (Baptista *et al.* 1997, Gibbs *et al.* 2001), and Baptista (1997) stated that research and survey work are required to fill this gap.

The aims of this paper are (i) to accurately assess the geographic distribution of Pink-headed Fruit-dove, (ii) to report comprehensively on the species' biology, and, with these data, (iii) to analyse its ecological and altitudinal requirements, and provide comments on the species' conservation status.

Methods

Data on Pink-headed Fruit-doves were collected during general bird surveys in 1981–2001. Most large forest areas within the range of the species were visited at least once. The species proved to be difficult to observe, and observations made by the first author (S. v. B.) are partly based on their characteristic vocalizations. Additional data on the species distribution and biology were compiled from literature, unpublished diaries and manuscripts of the Bartels family lodged at Naturalis, Leiden, and an unpublished manuscript on Javan birds by A. Hoogerwerf, lodged at the Zoological Museum Amsterdam, as well as by soliciting data from other observers. Breeding data were also solicited from several North American zoological gardens, i.e. Riverbanks Zoo, Birmingham Zoo and St Louis Zoo.

For a total of 32 mountains or mountain complexes (26 of which were included in our surveys), each separated by land stretches below 1,000 m altitude, we assessed the absence or presence of Pink-headed Fruit-doves. Proving the species' presence can, in principle, be established by a short survey, but demonstrating its absence is more difficult. "Negative data" therefore only included mountains

¹ Jambu Fruit-dove *P. jambu* is very confusingly also known under the name Pink-headed Fruit-dove.

that were ornithologically well explored, either by us or other ornithologists. For each mountain or mountain complex we compiled data on (i) presence or absence of Pink-headed Fruit-dove, (ii) the lowest altitude at which the species was recorded, (iii) approximate forest area of > 1,000 m altitude and (iv) altitude of the highest peak.

From a management and conservation perspective it is important to know what the altitudinal requirements of potentially threatened species are. In Indonesia, deforestation, and the resultant forest fragmentation, mostly starts in the accessible lowlands and gradually proceeds towards higher altitudes. Eventually lowland species may occur only marginally at higher altitudes, whereas for montane species, lower-altitude forests or forests on adjacent mountains become unavailable when no longer continuous with higher-altitude forest.

Sody (1956) showed that the altitudinal distribution of various Javan forest birds is strongly correlated with that of various plant species. This may imply that bird distribution is affected by two botanical processes i.e. the mountain mass elevation effect (van Steenis 1961, cf. Nijman 2003), and the *Massenerhebungseffekt* (van Steenis 1972, Bruijnzeel *et al.* 1993). The mountain mass elevation effect refers to the exclusive occurrence of (plant) species on mountains of a certain minimum elevation, where they can reach the lower limit of their distribution at much lower altitudes (van Steenis 1961). The effect is expressed as the difference between the lower altitudinal limit of a species' distribution and the height of the lowest peak on which it occurs. The *Massenerhebungseffekt* refers to the compression of vegetation zones (especially timberline and snowline) on smaller mountains and may allow montane birds to occur at lower altitudes on small mountains. We explored these two effects by comparing the presence and absence of Pink-headed Fruit-dove on small and large mountains, and, for those mountains where it was present, comparing the species' lower altitudinal limit on small and large mountains.

Breeding biology

A total of 104 skins were studied in the collections of Naturalis (NMNH), the Zoological Museum Amsterdam (ZMA) and the Zoological Museum Bogor (MZB). Skins were aged on the basis of the amount of pink on the head, nape and chest. On the basis of the amount of pink on the chest and primary moult, and in comparison with the similar-sized Eurasian Collared Dove *Streptopelia decaocto*, individuals that showed no or only the slightest traces of pink could be fairly reliably aged as < 1 month (C. S. Roselaar pers. comm.). Individuals that had a pink chest, nape and head were classed as adults.

Breeding seasons in Indonesia are influenced by the length of the dry season (Voous 1950) and differ between Sumatra and West Java (ever-wet) and East Java and Bali (relatively dry). In an attempt to model the breeding period of Pink-headed Fruit-dove, we compared the monthly proportion of juveniles to adults for West Java. For analysis, the year was separated into quarters, i.e. May–July (height of the dry season), August–October (transitional period towards the wet season), November–January (height of the wet season) and February–April (transitional period towards the dry season).

Results

Geographical and altitudinal distribution

We observed Pink-headed Fruit-dove at 11 mountain complexes during our fieldwork and documented their occurrence on an additional nine from our review of the literature and unpublished reports. From another 12 well-explored mountain complexes within the species' range we did not find any evidence of their occurrence (Table 1). Thus, from 20 major mountain complexes, each separated from each other by land below 1,000 m altitude, the presence of Pink-headed Fruit-dove has now been confirmed, i.e. three on Sumatra, 16 on

Table 1. Occurrence of Pink-headed Fruit-dove on Sumatra, Java, and Bali, Indonesia.

Mountain complex ^a (summit in m ^b)	Forest area >1,000 m (km ²)	Present altitudinal range of forest (m)	Altitudinal range <i>P. porphyreus</i> (m)
West Sumatra			
1. Mt Singgalang (2,877)	600	800–2,877	1,667
2. Mt Kerinci (3,805)	5,900	200–3,800	1,434–2,300
South Sumatra			
3. Mt Dempu (3,159)	2,100	600–3,100	2,000
TOTAL SUMATRA	8,600		
West Java			
4. Mt Karang (1,778)	30	1,000–1,778	470–900
5. Mts Halimun (1,929) ^c	350	500–1,929	950
6. Mt Salak (2,211) ^c	100	900–2,211	900–2,000
7. Mts Gede-Pangrango (3,019) ^c	130	500–3,019	525–3,000
8. Mt Tangkubanperahu (2,076)	100	1,500–1,900	1,500–1,600
9. South Priangan (2,821)	600	600–2,821	600–2,500
10. Mt Ciremai (3,078)	120	1,000–2,800	1,000–2,500
Central Java			
11. Mt Slamet (3,418) ^c	100	700–3,000	1,525–1,900
12. Mts Dieng (2,565) ^c	120	300–2,565	1,775
13. Mts Merapi-Merbabu (3,142) ^c	120	1,000–2,900	1,050
East Java			
14. Mt Lawu (3,265) ^c	180	1,000–3,000	1,850–1,925
15. Mts Liman-Wilis (2,563)	300	700–2,563	
16. Mts Kawi-Kelud (3,239) ^c	400	300–2,806	1,000–2,300
17. Mts Bromo-Tengger (3,676) ^c	200	200–3,500	1,800–1,900
18. Yang highlands (3,088) ^c	100	900–3,088	1,150
19. Ijen highlands (3,142) ^c	500	800–3,142	500–1,850
TOTAL JAVA	3,450		
BALI			
20. Mt Batukahu (3,142)	200	700–3,000	1,000–1,500
TOTAL BALI	200		
TOTAL SUMATRA, JAVA, BALI	12,250	0–3,805	470–3,000

^aLocations are numbered in a west-to-east sequence (see Figure 1).

^bAltitude refers to the highest peak of the mountain complex, and might be known under a different name (e.g. the highest peak of Mt Batukahu complex is Mt Agung; Pink-headed Fruit-doves have, however, not been recorded on this latter mountain).

^cObserved at this locality during our fieldwork.

Ornithologically well-explored mountain complexes (with altitude of highest peak) where Pink-headed Fruit-dove was found not to be present are on South Sumatra: Mt Rugung (1,964); on West Java: Ujung Kulon (623), Mt Pulosari (1,346), Mt Pancar (800), Mt Sanggabuana (1,291); on Central Java: Mts Serayu (682), Mt Ungaran (2,050), Mt Muriah (1,602); on East Java: Mt Penanggungan (1,653); Meru Betiri (1,221), Mt Baluran (1,247); and on Bali: Bali Barat (1,414).

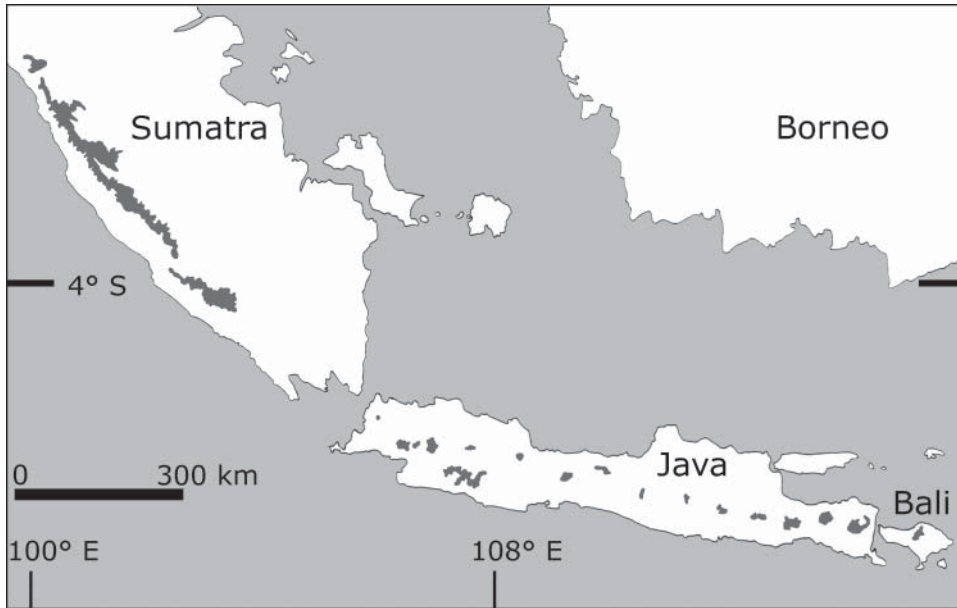


Figure 1. Distribution of Pink-headed Fruit-dove on Sumatra, Java, and Bali, Indonesia.

Java (including 11 during our fieldwork) and one on Bali (Figure 1 and Appendix). Most localities where the species has been recorded, and virtually all of those where it has been recorded recently, are situated on Java, where it is widespread and even occurs in reasonably large numbers, especially in the eastern part of the island. The distributional range on Sumatra is still quite extensive, but precise data on its current distribution are lacking. Pink-headed Fruit-dove has been recorded historically at two localities at one mountain complex on Bali, but no recent field data are available. However, fruit-doves being offered for sale at a local bird market (Appendix), some reportedly trapped on the island, suggest the species survives on the island.

Sizes of the forest areas in which the dove has been found range from 30 km² (Mt Karang) to almost 6,000 km² (Mt Kerinci), and overall the extent of occurrence is some 12,000 km². More than 60% of the forest areas in which Pink-headed Fruit-dove has been recorded are < 200 km², and over 25% are 100 km² or less (Table 1).

We recorded Pink-headed Fruit-dove between altitudes of 900 and 2,800 m, but it is common only above 1,200 m. The altitudinal range of the species is between 470 and 3,000 m (Table 1) but it occurs almost exclusively on mountains > 2,000 m (Figure 2). The two smaller mountains on which the species occurs are the strongly isolated Mt Karang (1,778 m) and Mt Halimun (1,929 m), both in West Java. Accepting the lower altitudinal limit of *c.* 500 m, the mountain mass elevation effect is some 1,200–1,300 m.

Whether or not the *Massenerhebungseffekt* influences the altitudinal distribution of Pink-headed Fruit-dove is difficult to assess, due to the paucity of records and the present discontinuity of lowland and montane forest. Circumstantial evidence from the late nineteenth and early twentieth century points in the direction that it does. On Mt Kerinci (3,805 m), Pink-headed Fruit-dove was not

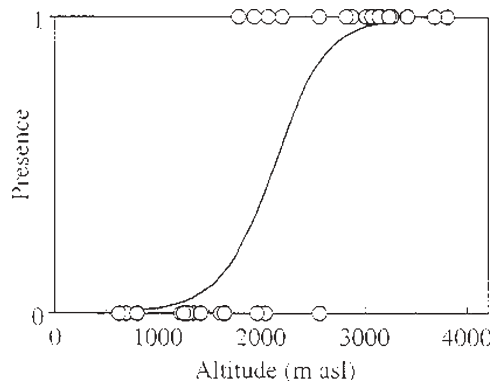


Figure 2. Logistic regression of the presence (1) or absence (0) of Pink-headed Fruit-dove, in relation to the altitude of 32 isolated mountain complexes.

found below 1,540 m, and was most common at 2,300 m, though not much above that (Robinson and Kloss 1918), whereas on Mt Karang (1,778 m) it was recorded down to 470 m (Nicholson 1882) and between 600–900 m (Robinson and Kloss 1924b). Furthermore, a lower altitudinal limit of <1,000 m tends to occur more often on small (<3,000 m) compared with large mountains (4/2 vs 2/9; Fisher Exact Probability Test, $P = 0.07$) (Table 1).

Habitat

We recorded Pink-headed Fruit-dove only in forest, although on occasions in rather open planted forest adjacent to mixed montane forest (including one case of breeding in a “puspa” *Schima wallichii* (Theaceae) tree; van Balen and Marhadi 1989). Indeed the species is described as a true forest bird, normally being recorded only in the interior or along the edges of primary forests (Hoogerwerf 1950), with a preference for lower montane oak-laurel and upper montane ericaceous forest (van Marle and Voous 1988). Only occasionally did the birds visit isolated fruiting fig trees in the vicinity of the forest (M. Bartels Sr unpubl. data).

Feeding

The only instance of feeding we recorded was on tiny, cauliflorous figs *Ficus* sp. (Moraceae). Other food items recorded are mainly small fruits, especially figs (Forbes 1885), the humid forest shrub *Ardisia javanica* (Myrsinaceae) (Becking 1989), small berries of the secondary forest and forest-edge liana *Embelia ribes* (*kacembang*; Myrsinaceae) (Nicholson 1881), unknown fruits with red seeds in shape resembling grape-stones (Vorderman 1886: 395) and cherry-sized orange-reddish fruits (C. Artuso unpubl. data).

Although normally rather sluggish, the birds are very agile in their movements when feeding in the canopy. Birds were mostly seen in high trees, sometimes descending to ground level, or low in bushes (M. Bartels Sr unpubl. data). Pink-headed Fruit-doves are shy, silent and inconspicuous, so amongst foliage in tall trees they were difficult to detect. The largest congregation seen

was 17 birds together in two loose flocks, in November (S. v. B.), but we mostly observed them as single birds or in pairs. The species also occurs in small parties of three or four (Robinson and Kloss 1918), and sometimes in larger flocks of up to nine birds together in fruiting trees (Andrew 1985). They have been reported to feed together with other species including barbets *Megalaima* spp. (Hoogerwerf 1950), or congeners such as Black-backed Fruit-dove *Ptilinopus cinctus* (Stresemann 1913).

Vocalization

A brief description of the dove's calls is given in MacKinnon *et al.* (1999). The following, more detailed description of its vocalization has been made for birds heard on Java: (i) most commonly heard is a deep, flat, or with slightly rising middle note, "woow", repeated at 5–6 second intervals in moderately long series; (ii) a deep and rather loud "hoo-hoo-KOOKOOkookookoo", accelerating and slightly dropping in pitch towards the end, also transcribed as "oOw, OOW, oo-oo-oo-oo-oo", with the second note louder and higher pitched.

Breeding

We documented two cases of breeding (van Balen and Marhadi 1989, Sözer and Nijman 1995): one at the beginning of October at 1,925 m on Mt Lawu (East Java) and one in late August at 1,775 m on Mt Prahū (Mts Dieng, Central Java), whereas Ooi Chin Hock (pers. comm.) reported an additional nest in May 1997 at c. 1,600 m on Mt Gede-Pangrango (West Java). All these cases were from the lower canopy of the forest. Nest-building appeared to be done solely by the male, which approached the nest in a very discrete manner by landing first in adjacent trees. The female was not seen taking part in nest-building, though she was perched in a nearby tree. The nest was typical of that of pigeons, consisting of an untidy construction of small dry twigs. During nest-building and incubation the doves did not seem to be easily disturbed and the birds concerned were approachable to a few metres. They seemed to rely on their inconspicuous body colour, with the only noticeable response to an observer being the male turning its body so as to conceal its brightly coloured head from view (van Balen and Marhadi 1989).

In birds held in captivity the incubation period averages 20 days ($n = 10$; max. 23 days) and the nestling period averages 15–16 days ($n = 5$; max. 17 days). Like most fruit-doves, males incubate during the day and females take over from dusk to dawn. Replacement eggs are laid within 10 days of losing the egg. Eggs are almost always abandoned within 24 hrs of the end of the incubation period. Never more than one egg per clutch is laid. Both parent birds participate in rearing the young.

In West Java, juveniles were collected in all months, with the exception of December to February, i.e. the height of the wet season. Analysis of the ratio of adults to juveniles reveals that significantly more juveniles are collected in the period May to July (G -test, $G_{adj} = 27.2$, $df = 1$, $P < 0.01$; Figure 3). With the information on incubation and nestling periods this suggests that egg-laying is mainly in the period March to May, i.e. the beginning of the dry season.

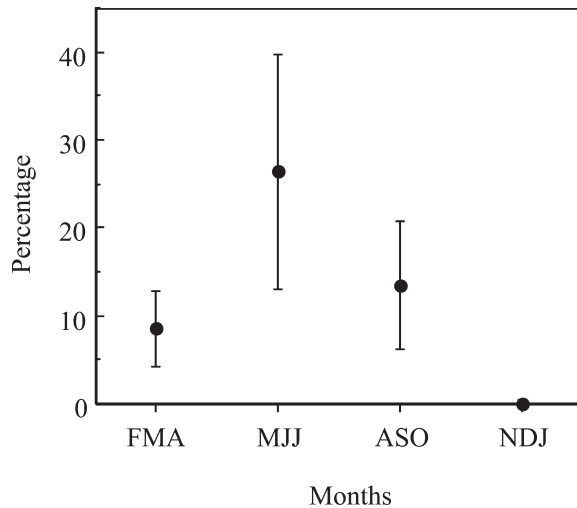


Figure 3. Seasonal variation in occurrence of juvenile (< 1 month of age) Pink-headed Fruit-dove in West Java, expressed as percentage of all age-classes (average \pm 1 SE). Based on 86 skins from the collections of Zoological Museum, Amsterdam (ZMA), Naturalis (NMNH) and Zoological Museum Bogor (MZB).

Discussion

Distribution

We found Pink-headed Fruit-dove at altitudes of 900 m and higher. It has been recorded as high as 2,850–3,000 m in the summit area of Mt Pangrango (Junghuhn 1853, Andrew 1985), but this may be exceptional as the species does not normally surpass the 2,400 m boundary (Hoogerwerf 1950). For Java, Sody (1956) gives a lower altitudinal limit of 150 m, most likely based on the 500 ft mentioned by Bartels (1906) for Mt Malabar. This, however, seems to refer to a printing error in the latter paper, as later M. Bartels Sr (unpubl. data) reports the extreme rareness of the species in the lower regions, with only one observation as low as 525 m on Mt Pangrango. Moreover, the slopes of Mt Malabar nowhere descend to below 400 m. On Mt Ijen (East Java) Robinson and Kloss (1924b) collected a specimen at Tamansari at 500 m.

Our data indicate that probably both the mountain mass elevation effect and the *Massenerhebungseffekt* play a role in determining the altitudinal distribution of the species. In explaining the presence and distribution of Pink-headed Fruit-doves on mountains, the above-mentioned effects can not be separated from a third, i.e. that of the available area of suitable (montane) habitat (Mayr and Diamond 2001). Smaller mountains comprise less habitat than larger, and thus offer fewer survival chances for forest-dependent species. The more isolated the mountain, the more pronounced this effect will be as the influence of nearby larger mountain blocks will be less.

Breeding biology

Breeding of this species is very little known (Hellebrekers and Hoogerwerf 1967, Gibbs *et al.* 2001). Even the Bartels family, resident for decades in the mountains

of western Java, never found a nest despite their undoubtedly intensive searches. van Balen and Marhadi (1989) reported a nest containing three downy chicks, a highly unusual clutch size for this tropical genus with clutches never otherwise more than one, as indeed stated in the same paper. B. Bohmke (*in litt.* 1990 *per* R. Seibels) rightly pointed out this anomaly. In light of the above data on incubating and nestling periods (20 and 16 days, respectively), the observation that chicks are downy for the first 5–7 days (B. Bohmke *in litt.*), and the long time-span between the discovery of the incubating male and next observation (37 days) suggest that the nest failed and was taken over by another columbid with a larger clutch (B. Bohmke *in litt.*).

The breeding season of Pink-headed Fruit-dove in perhumid West Java appears to be concentrated in the dry season, with the peak of egg-laying occurring at the beginning of the dry season (March–May). Also in West Java, the sympatric Black-naped Fruit-dove *Ptilinopus melanospila* shows a clear egg-laying peak in May (Hoogerwerf 1949, Hellebrekers and Hoogerwerf 1967). We have no data on breeding in the drier East Java or Bali, but as in other birds, the breeding season is probably more sharply defined in areas where the dry season is more pronounced (Voous 1950).

Conservation implications

Although Pink-headed Fruit-dove appears to be present in various overseas zoos (e.g. U.S.A., Germany), the species appears only sporadically in Indonesian bird markets and there seems to be no market in South-east Asia. Bird market statistics for 1990–1992 show a preponderance of fruit-doves from the Papuan region (Nash 1993), and during our numerous visits to bird markets we observed Pink-headed Fruit-doves for sale only three times, in a bird market on Bali. However, local populations depleted by trapping, the economic collapse in Indonesia and the capriciousness of the bird trade (with continuously changing favourite cage birds) may divert the attention of bird-trappers and -traders towards these beautiful doves.

Pink-headed Fruit-dove is recognized as a restricted-range species, i.e. its global breeding range is less than 50,000 km² (Stattersfield *et al.* 1998). We have shown that the species' range is in fact merely some 12,000 km², scattered over 20 different mountain complexes on three islands. In Sumatra its range is a more or less continuous block of forest, but due to the paucity of data we have no information on how much of this is indeed inhabited by the species. Deforestation on Sumatra has increased dramatically over the last decade (Whitten *et al.* 2000), and although montane forests are less threatened than lowland forests, they are far from secure. On Java the mountains are more scattered, and the 16 discrete patches are each fragmented into a number of smaller areas. Java is already severely deforested, especially in the lowlands, and pressure on montane forest is increasing by illegal logging, agricultural encroachment, mining, geothermal projects and development for tourism. The remaining montane forests on Bali are small, but in comparison with Java and Sumatra, relatively secure. Unfortunately, despite Bali being frequently visited by birders and ornithologists (including ourselves) we have no data that confirm the continued presence of Pink-headed Fruit-dove on the island.

The species' fragmented distribution, its limited extent of occurrence, the continuing deterioration of its habitat and the paucity of records might warrant it to be considered Vulnerable under the criteria for the IUCN threatened categories (Collar *et al.* 2001). Despite the strikingly coloured head, we found the species to be difficult to observe, as with its overall body colour and its inconspicuous behaviour it blends perfectly with its environment. We therefore feel the species may be more common than might be assumed from the number of records. Although we feel that as yet Pink-headed Fruit-dove's status is not as precarious as the above-mentioned facts may suggest, caution remains needed, and legal protection and monitoring schemes should be considered.

Acknowledgements

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Appendix. Localities of observations and collections of Pink-headed Fruit-dove *Ptilinopus porphyreus*.

West Sumatra, [Mentawai Islands, May 1974, 150 m, Sipora Island [(K. V. Thompson, in van Marle and Voous 1988)];² Mt Singgalang: Jun–Jul 1878, 9 skins coll. O. Beccari, mostly at 1,667 m (Salvadori 1879: 245); Mt Kerinci: Apr–May 1914, fairly common, 21 skins coll. H. C. Robinson and C. B. Kloss, 1,540 m, Sungai Kumbang and 2,230 m, lower part Kerinci peak and not met with much above this (Robinson and Kloss 1918: 106; MZB); Jul 1981, 2 seen, 2,000 m, Kersik Tua (F. G. Rozendaal pers. comm.); Aug–Sep 1983 (B. King in van Marle and Voous 1988); Jun 1989, 5+ seen, mostly lower down Mt Kerinci (Lewis *et al.* 1989); Aug 1994, pair, 1,700 m (D. Allen unpubl. data); April 2001, 1–6 birds in fruiting tree on 4 days, 2,000 m, Mt Kerinci (C. Aruso, *in litt.*); *South Sumatra*, Mt Dempu: Aug 1916, 3 skins coll. E. Jacobson, 2,000 m, above Pasemah Estate (Robinson and Kloss 1924a: 209; NMNH); *West Java*, Mt Karang: Jun–Jul 1879, 2 skins coll.

² Although the original field notes by Thompson (archives K. H. Voous, lodged at the ZMA) appear to leave little doubt about the identity of the bird, this extremely anomalous record is not included by us in further analyses.

H. O. Forbes, 470 m, Kosala Estate, Mt Endut (Nicholson 1881: 155; Forbes 1885: 72); Apr 1920, coll. C. B. Kloss, 600–900 m, Ciomas (Robinson and Kloss 1924b: 269); **Mt Halimun**: 1922–1924, observations (M. Bartels unpubl. data); Aug 1986, plucked feathers, c. 950 m, Nirmala (S. v. B.); **Mt Salak**: Oct 1882, 1 skin coll. A. G. Vorderman, 2,000 m, SE slope (Vorderman 1886: 395); Jun 1897, rather common, 2 skins, 1,000 m, Mt Endut (Bartels 1902: 166; NMNH); May 1921, 1 skin coll. Bartels, Mt Masigit, 15 km west of Cibadak (NMNH); not uncommon, Ciomas, N slope (Hoogerwerf 1948); Aug 1981, 1,350 m, Pasirreungit (S. v. B.); Sep 1988, 1,350 m, Awibengkok (S. v. B.); **Mt Gede–Pangrango**: summit area (Junghuhn 1853: 608); Oct 1861, 1 skin coll. A. R. Wallace, 2,300–2,700 m (Wallace 1869: 93); two skins coll. Bernstein, Gadok, Mt Gede (NMNH); Oct. 1896, two skins coll. J. Z. Kannegieter, Cibodas (NMNH), Mar–May 1889, 5 skins coll. A. G. Vorderman, Mt Gede (Vorderman 1892: 400; NMNH and MZB); dates unknown, 3 skins coll. Schlüter, above Sukabumi, SW slopes (NMNH); Jun 1909, 1 skin coll. Bartels, Cideng (NMNH); 1904–1914, rather common, 47 skins coll. M. Bartels, 1,000–3,000 m, Mt Pangrango (Bartels 1902: 166; NMNH); Sep 1903, 2,000 m, Mt Pangrango (Bartels 1906: 513); Feb 1916, Cibodas and Kandangbadak, 2,400 m (Robinson and Kloss 1924b: 269); Cimungkat, 900–1,000 m (Bartels 1917: 264); Jun 1928, 1 skin (MZB); Jul 1926, occasionally seen, Cibodas (Delsman 1927); Jun 1933, 1 skin coll. Saan (MZB); Jul 1981, pair, 1,900 m, Cibodas (S. v. B.); Feb 1986, single bird, photographed, 1,500 m, Ciloto, Puncak/Megamendung (S. v. B.); uncommon throughout, but more common at higher altitudes, up to 2,850 m (Andrew 1985: 15); Jul 1988, two (Richards and Richards 1988); spring 1988, one at c. 2,000 m (Andrews 1989); Jul 1991, three+ (Heath 1991); Jun 1994, two pairs, at c. 1,600 m (Tobias and Phelps 1994); Jul 1990, one along trail (S. Henson *in litt.* 1996); May 1997, breeding above Cibodas, at c. 1,500–1,600 m (Ooi Chin Hock verbally 1997); Aug 1998, five+ in fruiting tree, at c. 1,600 m (R. Goldbach 1999); **Mt Tangkubanperahu**: Oct 1926, 10 skins coll. F. C. van Heurn, 1,500–1,600 m (NMNH); Jun–Oct 1926, 3 skins coll. Coomans de Ruiter (NMNH, MZB), Oct 1928, 3 skins coll. F. C. van Heurn 1,500 m (ZMA), 1955–1957, 3 skins coll. M. van Balgooy (NMNH); **South Priangan**: Apr 1927–Nov 1929, only one sighting, 600–1,000 m, Kole Beres, Mt Patuha (Bartels 1931: 308); one coll. H. O. Forbes, near Pangalengan, Mt Malabar (Nicholson 1882: 69); Apr–May 1910, 6 skins coll. van der Weele, Tirtasari, 1,789 m, Mt Malabar (NMNH); May 1910, 5 skins coll. van der Weele, Cinyiruan, Mt Malabar (NMNH); down to 150 m [altitude most likely erroneous, see Discussion], Mt Malabar (Bartels 1906: 513; NMNH); coll. L. Biesenbach, Mt Papandayan (Stresemann 1930: 426); Sep 1941, 1 skin coll. A. de Vos, 2,500 m, Mt Papandayan (MZB); Jun 1923, 1 skin coll. Madzoed, Kawah Kamojang, 1,400 m, Mt Guntur (MZB); **Mt Ciremai**: 13 skins coll. Menden, 1,000–2,500 m (MZB); *Central Java*, **Mt Slamet**: 1916–1917, 4 skins coll. Denin, Kaligua (MZB); 1,525 m (M. Bartels, unpublished data); Jun 1995, three, 1,900 m, above Bambang (S. v. B., V. N.); **Mts Dieng**: Aug 1994, nest-building pair, 1,715 m, E slope Mt Prahu (Sözer and Nijman 1995: 116); **Mt Merapi–Merbabu**: Nov 1995, loose flock of 17 birds, 1,050 m, Kaliurang, Merapi (S. v. B.); *East Java*, **Mt Lawu**: Oct 1988, nesting, 1,925 m, Cemorsewu (van Balen and Marhadi 1989: 144); Jul 1995, heard, 1,850 m, Cemorsewu (S. v. B., V.N.); **Mts Liman Wilis**: Jul 1995, reportedly present (Messrs Senin and Sumardi pers. comm.); **Mts Kawi/Arjuno**: Jan 1896, 1,000 m, Mt Arjuno (Hartert 1896: 542); Jan–Nov 1927, 8 skins coll.

Rothschild, Mt Arjuno (MZB); Aug 1992, uncommon, above 2,000 m, Mt Arjuno (S. v. B.); Jul 95, 1,300 m, Mt Anjasmoro (S. v. B.); Apr 1993, 1,200–1,400 m, Dorowati (S. v. B.); May 1993, Dadapan, Mt Kawi (S. v. B.); Apr 1993, common, 1,800–2,300 m, N slope Mt Kawi (S. v. B.); early 1990s, unconfirmed, Mt Penanggungan (files PPLH Trawas); **Mts Bromo/Tengger**: Oct 1938, 2 skins, coll. Kooiman, Ngadiwono, 1,879 m (NMNH); Mar 1991, not uncommon, tape-recorded, c. 1,800 m, SE slopes (S. v. B. pers. obs.); **Yang highlands**: Feb 1939, 1 skin coll. Kooiman, Gondang, S slopes (NMNH); Jul 1989, one seen, 1,150 m, above Baderan (S. v. B.); **Mt Ijen**: Feb 1917, 1 skin coll. Bartels, Sumberwringin (NMNH); Mar–Apr 1916, coll. H. C. Robinson, 1,850 m, Ongop-ongop, 1170 m, Sodongjerok and 500 m, Tamansari (Robinson and Kloss 1924b: 269; MZB); Jun 1924, 1 skin coll. Dammerman (MZB) Jun 1990, common, tape-recorded, 1425–1525 m (S. v. B.); **Bali, Mts Batukahu/Batur**: Jan 1911, 3 coll., 1,000 m, Bratan Lake (Stresemann 1913: 328); Jan 1938, 2 skins coll. von Plessen, Buliau, Buyan Lake (NMNH). In Jun 1989, Feb 1993, and Oct 2003 respectively four, three, and one Pink-headed Fruit-doves were offered for sale at the Ksatria bird market in Denpasar; the last was said to have been taken from the forest on Mt Batur.

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