

THE BIRDS OF THE KANGEAN ISLANDS, JAVA SEA, INDONESIA, AND AN APPRAISAL OF THEIR CONSERVATION STATUS

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ABSTRACT

The Kangean islands are a biologically poorly known archipelago situated in the Java Sea, Indonesia, 120 km directly north of Bali and 124 km off East Java. These islands host an avifauna comprising at least 13 endemic subspecies, two of which have by some sources recently been considered species. We combine historical published literature with our own surveys of the archipelago in 2007–2008, 2010 and 2023 to produce an updated list of the islands' birds (n=140 species) and their distribution across the islands. We evaluate in more detail the conservation status of all endemic taxa, as well as several others we consider to be of concern. Despite its current listing as Vulnerable on the IUCN Red List, the endemic Kangean Tit-babbler *Mixornis prillwitzii* is common in highly degraded habitats, including scrub, and is probably one of the islands' least threatened birds. However, because of trapping, the archipelago's endemic taxon of Red-breasted Parakeet *Psittacula alexandri kangeanensis*, and its populations of Green Junglefowl *Gallus varius* and Common Hill Myna *Gracula religiosa* are likely at risk of extirpation. The endemic taxon of White-rumped Shama *Copsychus malabaricus nigricauda*, sometimes afforded species rank as 'Kangean Shama', may already be (at least functionally) extinct in the main archipelago, with no record since 2007–2008. We recommend longer and more detailed surveys of the islands' birds, and that an effective protected area is established on the main Kangean island, which hosts the largest area of remaining forest in the archipelago and most of its endemic taxa.

Key words: conservation, endemism, Indonesian islands, threatened species

INTRODUCTION

Indonesia is recognized globally as a biodiversity hotspot (Myers et al., 2000) with an exceptional scale of endemism spread across the world's largest archipelago, made up of more than 18,000 islands (Cribb & Ford, 2009). The country is home to more than 1,700 bird species, of which >500 are considered endemic (more than any other country: BirdLife International, 2023). But Indonesia's fauna is also highly threatened. Nearly 20% of its endemic bird species are considered threatened with extinction (global average: c.13%; BirdLife International, 2023), with habitat loss and trapping the key ongoing threats to their survival (Harrison et al., 2016; von Rintelen et al., 2017; Symes et al., 2018). Indonesia's avifauna is still comparatively poorly studied: species new to science continue to be described (e.g. Rheindt et al., 2020; Milá et al., 2021; Irham et al., 2022, 2023) and even basic facets of breeding biology are unknown for many

species (Noske, 2017). These knowledge gaps are particularly acute for species with remote ranges less accessible to amateur and professional ornithologists.

The Kangean archipelago lies c.120 km north of Bali and c.124 km north-east of East Java, and comprises more than 50 islands, (in descending order of size of those labelled in Fig. 1): Kangean (450 km²), Sepanjang (102 km²), Paliat (47 km²), Saobi (11 km²) and Sepeken (0.7 km²). Most islands are low-lying (0–50 m asl.) but undulating, with a ridge that runs west–east on Kangean, rising to a maximum elevation of c.300 m asl. in the center of the island; this ridge also runs across Paliat, where it reaches a peak elevation of only c.100 m asl. All the islands have seen most of the tropical forest that once covered them cleared, with what remains concentrated on the most rugged parts of the islands (principally the ridge on Kangean) (Google Earth, 2023). The remaining land area is covered by agriculture and (mostly teak) plantations, and the islands are bordered by mangrove forests, mudflats, and beaches (de Iongh et al., 1982; Irham, 2016). Only a single protected area (cagar alam), covering part of Saobi, is currently in place (the status of remaining habitats is discussed in more detail in the Discussion). The climate is that of tropical monsoon forest, with the wet season spanning approximately October to March (de Iongh et al., 1982). A more detailed summary of the islands’ habitats and climate is provided by de Iongh et al. (1982) and Irham (2016).



Figure 1. (Left) the Greater Sundaic region showing the location of the Kangean archipelago; (Right) Kangean islands mentioned specifically in the text.

Brief ornithological history of the Kangean islands

The first published ornithological visit to Kangean was made in May 1892 by A. G. Vorderman, who collected 44 species and described several new taxa from the island (Vorderman, 1893). In 1901, E. Prillwitz made a more comprehensive collection, raising the total number of known species to 78. His findings were published by E. Hartert, who described further new taxa (Hartert, 1901) and reviewed the islands’ birds (Hartert, 1902), with a principal focus on their taxonomy.

Aside from a visit to Saobi, off Kangean island, by F. J. Appelman in February 1938 to study the nesting behaviors of Orange-footed Scrubfowl *Megapodius reinwardt* (Appelman,

1938), the next dedicated ornithological survey did not occur until A. Hoogerwerf collected on Kangean, Paliat and Sepanjang in August–September 1954. The results of his efforts were published in numerous papers that reviewed the taxonomy of several species on Kangean, as well as other islands in the Java Sea (Hoogerwerf, 1962a, 1962b, 1962c, 1963a, 1963b, 1964, 1965). J. West surveyed the archipelago in July 1979 (West, 1980), shortly followed by an expedition led by WWF Indonesia in May–June 1982 chiefly searching for evidence of Leopard *Panthera pardus* (de Iongh et al., 1982). Combining all available survey efforts of the archipelago, de Iongh et al. (1982) published a total list of 99 bird species. Y. Sa’aroni and Nurwatha visited Kangean, Paliat and Sepeken 4–15 September 1996 and recorded 57 bird species (Nurwatha, 1996; Sa’aron & Nurwatha, 1996). While some (unpublished) private visits to the islands were made in the interim, it was not until a visit by Irham (2016) to several of the Kangean islands in 2007–2008 that a revised bird list, comprising 113 species, was published (see Methods). Budiman et al. (2018) recorded 58 bird species in November 2016, after which we are unaware of any other visits that produced published sightings.

Taxonomy and biogeography

The Kangean islands lie on the Sunda continental shelf (light blue on Fig. 1) and are separated from Borneo and Java by seas less than 75 m deep, thus were periodically connected to them both, probably as recently as c.12,000 years ago, during glacial maxima in the Pleistocene when sea levels were up to 120 m lower than today (Voris, 2000). Despite lying substantially closer to Java (124 km) than Borneo (c.300 km), Kangean shares avifaunal components with both. For example, it hosts populations of Javan Flameback *Chrysocolaptes strictus* and ‘Javan’ Hair-crested Drongo *Dicrurus [hottentottus] jentinki* (both otherwise endemic to Java/Bali), but also Bar-bellied Cuckooshrike *Coracina striata* and Sunda Frogmouth *Batrachostomus cornutus* (closest populations on Borneo). It also has species that occur closest in the Lesser Sundas (e.g., Orange-footed Scrubfowl *Megapodius reinwardt* and Black-faced Munia *Lonchura molucca*) and elements that are biogeographically peculiar, including a highly disjunct population of Green-billed Malkoha *Phaenicophaeus tristis*, a species that is present on Sumatra but absent from Java, Borneo, and the Lesser Sundas (Eaton et al., 2021).

Most global avian checklists currently recognize 13 subspecies as endemic to the Kangean islands (BirdLife International, 2023; Clements et al., 2023; Gill et al., 2023), one of which—Kangean Tit-babbler *Mixornis prillwitzii*—is now almost unanimously recognized at species rank (del Hoyo & Collar, 2016; Cros & Rheindt, 2017; van Balen & Irham, in prep.). The archipelago’s endemic taxon of White-rumped Shama *Copyschus malabaricus nigricauda* has also recently been suggested to merit species rank (Wu et al., 2022), thus heightening the islands’ conservation importance.

Historic compendia on the birds of Kangean have principally focused on their taxonomy (e.g., Hartert, 1902; Hoogerwerf, 1962a, 1963a, 1963b, 1963c, 1965; Sudaryanti et al., 2006) but not until Irham (2016) were the threats to the archipelago’s birds explicitly discussed. Here,

we build on the work of the latter (whose summary was based on surveys in 2007–2008), complementing historical and previously published data with additional surveys made in 2010 and 2023 to provide an updated list of the birds of the Kangean archipelago, their distribution, and the conservation status of taxa of concern.

MATERIALS AND METHODS

We compiled all published observations (Vorderman, 1893; Hartert, 1902; Hoogerwerf, 1962a, 1962b, 1962c, 1963a, 1963b, 1964, 1965; West, 1980; de Iongh et al., 1982; Nurwatha, 1996; Irham, 2016; Budiman et al., 2018) and combined them with our own surveys to produce an updated list of the birds known from the Kangean islands. For completeness and additional biogeographic interest, the Appendix includes lists from the islands of Raas and Sapudi (located between eastern Madura and Kangean; Vorderman, 1893). As effort allowed, we also indicate the distribution of each of these species on the archipelago's three main islands (Kangean, Paliat, Sepanjang: see Fig. 1) as well as Sepeken. Our own visits to the islands comprised the following: MI visited Kangean March–April and August–September 2007, Sepanjang June–July 2008, and Paliat in December 2008; a summary of this effort has already been published (Irham & Marakarmah, 2009; Irham, 2016), with the precise sites visited listed in Irham (2016). One of us (SvB) spent one week in the archipelago 18–24 December 2010: two plus days on Kangean, two days on Paliat, and two days on Sepanjang. AJB and CLR spent four days on Kangean 5–8 June 2023. Surveys by SvB, AJB and CLR followed no prescribed method, with observations made opportunistically and evidenced where appropriate with photographs and sound recordings. Generally, forests were targeted by AJB and CLR to maximize opportunity to detect forest-dependent endemic taxa, but agricultural and coastal sites were also visited. Where possible, AJB and CLR sought information from local people on trapping pressure on Kangean.

We combined historical and recent data from the islands to produce a complete checklist of the islands (taxonomy, nomenclature and sequence follow BirdLife International [2023]).

RESULTS

We collated a total list of 140 species for the Kangean archipelago, including eight threatened (Vulnerable, Endangered, Critically Endangered) and 11 Near Threatened species according to the IUCN Red List (Appendix). Main Kangean island was the most speciose island (n=110 species), followed by Paliat (n=57) and Sepanjang (n=54). Of the 140 bird species recorded, 37 species are migrants, presumed to be only seasonal visitors to the archipelago, leaving 103 resident species. Among these residents are the 13 taxa considered endemic to the islands, of which a majority (n=9) are apparently confined to Kangean and Paliat. Eurasian Tree Sparrow *Passer montanus* is the only non-native species recorded in the archipelago but see the Java Sparrow *Padda oryzivora* account below. We excluded nine species from our list that we believe to have been misidentified by previous authors; these species are indicated in grey in the Appendix.

Species accounts

All species with recognized taxa endemic to the Kangean islands (n=13; denoted by *) are given a species account below, describing their distribution and conservation status. A further 11 species are afforded accounts where a comment on their taxonomic, distributional and/or conservation status was pertinent. Among these are three ill-defined/ill-justified subspecies (denoted by #) described as endemic to the Kangean islands but later rendered invalid by subsequent authors (and not currently recognized by any global taxonomic checklist). The IUCN Red List status of each species is given (per IUCN, 2023), where LC = Least Concern, NT = Near Threatened, VU = Vulnerable, EN = Endangered, and CR = Critically Endangered.

Orange-footed Scrubfowl *Megapodius reinwardt* (LC)

Confirmed records from Paliat, Sepanjang and Saobi. W. F. H. van Ameron (in Vorderman, 1889) also reported Orange-footed Scrubfowl from several small, at the time uninhabited, islets east of Sepeken (e.g., Saular, Sitabok, Pagerungan Besar and P. Kecil, Sadulang Besar and S. Kecil, and Sakalar). In eastern Kangean, MI identified what may have been an abandoned nest mound of this species (Irham, 2016). MI located five nest mounds in a single day on Saobi and found the bird to be common on Sepanjang in 2008 (Irham, 2016). SvB also found an active or likely active nest mound on Paliat (the first confirmed record from there) and several nest mounds on Sepanjang in 2010.

This species is evidently tolerant of egg harvesting throughout its Indonesian range, but the absence of any data from the Kangean islands since 2010 prevents any accurate appraisal of its conservation status there. On Saobi, a large proportion of breeding birds occur in a nature reserve, although the realized protection this confers is unknown (see Discussion). Perhaps most concerningly, local people reported to SvB in 2010 that adult scrubfowl on Sepanjang are often snared. In a pattern that probably mirrors circumstances throughout its Indonesian range, we note that many of the small islands listed for the species in Vorderman (1889) now appear to be densely populated and entirely cultivated (Google Earth, 2023), indicating that the scrubfowl has almost certainly been extirpated from these islets.

Green Junglefowl *Gallus varius* (LC)

Confirmed from only Kangean but plausibly occurs, or at one time occurred, more widely. Cocks are highly sought by local people for breeding with domestic fowl to produce first-generation hybrid roosters (*'bekisar'*) for use in rooster singing competitions on Java (van Gennep, 1896; Hartert, 1902; Irham, 2016).

Green Junglefowl was reported from Kangean in all published surveys up to the 21st century (Vorderman, 1893; Hartert, 1902; West, 1980; de Iongh, et al., 1982; Nurwatha, 1996) and Prillwitz collected a series of five specimens in 1901 (Hartert, 1902). By 2007–2008, the population was described by a local resident as “decreasing steadily due to overharvesting” and in several months of fieldwork MI recorded only one (presumed) family group (Irham, 2016).

Budiman et al. (2018), SvB, AJB and CLR failed to detect this species during their visits in 2010, 2016 and 2023.

This pattern of records is striking and indicative of a rapid decline on Kangean over the last two decades. Green Junglefowl has high detectability (with far-carrying vocalizations) and is very tolerant of degraded forests (authors pers. obs.) such that habitat loss and degradation is unlikely to have been a proximate factor in its apparent decline. In 2023, two local trappers (pers. comm. to AJB) were similarly pessimistic about the species' contemporary status on Kangean, describing it as “rare” with neither having seen it during the last two years (although both were adamant that it does persist).

Ruddy Cuckoo-dove *Macropygia emiliana* [megala*] (LC)**

Endemic taxon *megala* present on Kangean and Paliat. Collected by Vorderman (1893) and Hartert (1902) but, perhaps surprisingly, not Hoogerwerf (1965), who expressed some skepticism about the taxonomic validity of *megala* given the small sample from which it was described. The song of this race is undifferentiated from other *M. emiliana* taxa (authors pers. obs). Hunting does not appear to depress numbers of this species and it is relatively common where found, with birds detected in natural forests (including those which have been heavily modified) and mature teak plantations. This taxon is probably secure in the near-term.

On 7 June 2023, a single bird was observed constructing a stick nest high in a large emergent tree that protruded from a small ridgetop. The nest was tucked into a thick mat of dense epiphytes that encased a large branch.

Grey-cheeked Green-pigeon *Treron griseicauda* [vordermani*] (LC)**

Endemic taxon *vordermani* present on Kangean and Paliat. The taxonomy of this form was reviewed by Hoogerwerf (1962b), who concluded from the specimens available to him that in many respects *T. g. vordermani* is unlike *T. g. griseicauda* of mainland Java, and more closely resembles Thick-billed Green-pigeon *T. curvirostra hypothapsinus*, a taxon that is sometimes considered a monotypic species (‘Barusan Green-pigeon’ *T. hypothapsinus*) but is otherwise endemic to the Barusan islands and islands off West Java (Eaton et al., 2021). Further taxonomic study is needed.

The conservation status of Grey-cheeked Green-pigeon on Kangean is difficult to evaluate: Vorderman (1892), Prillwitz (Hartert, 1902) and Hoogerwerf (1962b) all collected it (the latter several specimens), and it was observed by West (1980), de Iongh et al., (1982) and Irham (2016), but not Nurwatha (1996) or Budiman et al. (2018). SvB saw only a single group of six in a fruiting fig tree (Paliat), and AJB and CLR did not detect it. Like many *Treron*, it may be locally nomadic (Gibbs et al., 2001) in response to fruiting trees and dependent to some (unknown) extent on native forest. Elsewhere in its range, it is tolerant of disturbed forests, but the widespread removal of native vegetation on Kangean may disrupt a temporally and spatially

variable network of feeding sites. More research is needed, but the absence of observations in 2023 prompts some concern.

Pink-necked Green-pigeon *Treron vernans* [#kangeana] (LC)

Present on Kangean and Paliat; the islands' population was named as an endemic taxon—*kangeana*—by Mayr (1938), but this is not currently accepted by any global taxonomic checklist. In his consideration of bird speciation on the island of Java, Mees (1996) opted to ignore any color characters claimed for all 14 described subspecies of *T. vernans* and proposed two possible arrangements: (1) a single subspecies for large islands and a second larger subspecies for the smaller islands (including Kangean); or (2) treat the species as monotypic. The latter is now widely accepted (e.g. Eaton et al., 2021; BirdLife International, 2023; Clements et al., 2023; Gill et al., 2023). However, Mees (1996) concluded by saying that “in the framework of the present article, a decision on the nomenclature of the small-island populations [including *kangeana*] is unnecessary”, which leaves the matter open to further review.

Notwithstanding its taxonomic validity, the population of Pink-necked Green-pigeon on the Kangean islands is probably relatively secure. The species was observed by all visitors to the islands (except de Iongh et al., 1982) and by most was encountered in open habitats, as is typical of Pink-necked Green-pigeon elsewhere.

Green Imperial-pigeon *Ducula aenea* [?] (NT)

The Kangean population of Green Imperial-pigeon is currently included in *D. a. polia* (otherwise found throughout the Greater and Lesser Sundas: Gibbs et al., 2001), but Hoogerwerf (1963c) proposed that it might warrant taxonomic recognition, writing “it is evident that Kangean birds are much lighter in weight [than other *D. aenea* taxa]...collected by me in the areas around and on Java” and differs from *polia* further in possessing “a longer tail and a more slender body”. Due to a lack of fresh *polia* material with which to compare the two more accurately, Hoogerwerf declined to name Kangean's birds taxonomically but concluded that “there seems enough reason to do so”. We recommend a taxonomic re-appraisal of this population. It is unlikely to be of immediate or near-term conservation concern as all our visits to the islands detected it frequently in the forest. We found no evidence of hunting of this species or other large pigeons.

Zebra Dove *Geopelia striata* (LC)

This adaptable species approaches the eastern limits of its natural range in the Kangean islands, although its distribution in the archipelago is confounded by historical trapping pressure. Vorderman (1893) and Prillwitz (Hartert, 1902) both collected it but with no indication of its abundance. By 1980 it was apparently much depleted: West (1980), de Iongh et al. (1982), Nurwatha (1996) and SvB (in 2010) all failed to find it. In 2007-2008, MI found approximately 25 individuals over several weeks of fieldwork, indicating that the species nonetheless persisted, but commented that trapping pressure for this species on Kangean was very high (Irham 2016),

as it was throughout Java at the time (SvB pers. obs.). Budiman et al. (2018) found the species but with no indication of abundance. Given Zebra Dove's preference for (heavily) modified habitats, such scarcity can have been driven only by trapping.

By 2023, Zebra Dove had evidently recovered, following an increasing lack of interest in the species by bird fanciers on Java. AJB and CLR found the species to be very common in open areas and teak plantations, including around villages (e.g. a c.5-km transect through open countryside recorded at least 48 individuals). This pattern of records mirrors observations on neighboring Madura Island, where visits in 1992 (8 days), 1995–1996 (8 days) and 2006 (4 days) found no Zebra Doves, but subsequent visits from 2009 found them to be increasingly common; by 2019 the species was (at least locally) abundant, with 168 counted in five days (SvB pers. obs.). This remarkable recovery highlights how quickly adaptable species can recover when trapping pressure eases, and has potential repercussions for other, similarly depleted species on Java, including Java Sparrow, Javan Myna *Acridotheres javanicus* and Javan Pied Starling *Gracupica jalla*.

Green-billed Malkoha *Phaenicophaeus tristis* [*kangeangensis] (LC)

Endemic taxon *kangeangensis* known only from Kangean. Both Vorderman (1893) and Prillwitz (Hartert, 1902) collected this species and the latter procured a relatively large series of six specimens, suggesting it was not scarce historically. For reasons that are entirely obscure, it now appears to be so.

Green-billed Malkoha was not reported by West (1980), de Iongh et al. (1982), Nurwatha (1996) or Budiman et al. (2018). It was not observed by SvB in 2010 and, in several weeks of fieldwork, MI recorded only two: one in teak forest (on the edge of natural forest), and another hunted but live bird shown to him at the eastern end of Kangean (Irham, 2016). In 2023, AJB and CLR found three, two on the edge of selectively logged forest and another in a small area of heavily degraded forest surrounded by agriculture and newly planted teak.

The apparent scarcity of this species on Kangean is surprising and merits further investigation. All our sightings occurred in modified forest, and on Sumatra (the geographically closest population) the species is common (Eaton et al., 2021).

Greater Coucal *Centropus sinensis* [*kangeangensis] (LC)

Endemic taxon *kangeangensis* is apparently present throughout the Kangean archipelago, with records from Kangean, Paliat, Saobi and Sepanjang. It was recorded by all visitors to the islands. This subspecies is unique among Greater Coucal taxa for possessing two color morphs: black (normal) and buff (unique). The ratio of black:buff birds has been recorded as follows: Vorderman 3:2, Prillwitz 5:4, Hoogerwerf 4:2, MI c.70:2, SvB 4:1, AJB and CLR 8:0 (Vorderman, 1893; Hartert, 1902; Hoogerwerf, 1964; authors pers. obs.). Whether these data are indicative of a true change in relative abundance is unknown, but the suggestion made by

Stresemann (1939) that buff birds were replacing black ones no longer seems correct (if it ever was).

The habitat used by Greater Coucal on the Kangean islands is congruent with that elsewhere, with the species using agricultural landscapes, plantations, and heavily degraded forest, but shunning intact native forest. It has therefore almost certainly increased in abundance in response to the widespread loss and degradation of Kangean's forests and was observed to be common by all of us on each island visited. Thus, in the near-term, it is among the endemic taxa of least conservation concern.

Sunda Frogmouth *Batrachostomus cornutus* [longicaudatus*] (LC)**

Endemic taxon *longicaudatus* known from Kangean and Sepanjang (and therefore probably Paliat and perhaps other satellites). Frogmouth species limits are largely delimited by vocalizations, which led Eaton et al. (2021) to speculate that *longicaudatus* “may be more closely related to [Javan Frogmouth *B. javensis*]” of Java, given its proximity and the fact its vocalizations were wholly unknown. AJB and CLR sound-recorded at least two *longicaudatus* on Kangean in June 2023, finding them undifferentiated from *B. cornutus* (and therefore different from *B. javensis*). Accordingly, we recommend *longicaudatus* continue to be treated a subspecies of *B. cornutus*.

As is the case for many nocturnal birds, evaluating the conservation status of this species is obscured by its low detectability. Hoogerwerf (1964) procured four specimens from Sepanjang, and MI mist-netted a single bird in mangroves in eastern Kangean (Patapan) (Irham, 2016). SvB did not conduct nocturnal surveys, while AJB and CLR found at least three individuals on Kangean in June 2023, all from a single site in degraded forest along the central ridge.

Selective logging is unlikely to impact this taxon. Although confirmed from only a single site in 2023, it appeared locally common there in forest featuring a tangled understory and near-complete canopy cover, but from which almost all large trees had been removed. It is notable that MI mist-netted a bird in mangrove forest. Given the extensive mangrove cover on the perimeter of most islands in the Kangean archipelago, which is comparatively resistant to human exploitation, this habitat has the potential to host a significant population of frogmouths if the species' occurrence in mangroves proves not to be marginal.

Sunda Scops-owl *Otus lempiji* [kangeanus*] (LC)**

Endemic taxon *kangeanus* known from only Kangean, although nocturnal searches on other islands have been few and it may prove more widespread. Eaton et al. (2021) speculated that the taxonomic rank of this subspecies merited further research, implying that its disjunct range may merit it species rank if its vocalizations proved distinct from neighboring Sunda Scops-owl populations. However, sound recordings of two individuals made by AJB on Kangean in June 2023 were unremarkable, sounding undifferentiated from neighboring populations of *O. lempiji*. We therefore support the continued treatment of *kangeanus* as a subspecies of *O. lempiji*.

MI observed six in natural and teak forest. AJB and CLR heard several at a single site (the only one surveyed at night), comprising disturbed/selectively logged native forest adjacent to a teak plantation with little understory. Elsewhere in its range, Sunda Scops-owl is relatively plastic in its habitat use, occurring in well-wooded parks and gardens etc. (König & Weick, 2008; Eaton et al., 2021; authors pers. obs.). On Kangean, this species evidently also tolerates some forest disturbance and it is probably not at immediate risk. We found no evidence of trapping of this species on Kangean.

Javan Flameback *Chrysocolaptes strictus* [*kangeanensis] (VU)

Endemic taxon *kangeanensis* present on Kangean and Paliat. Although collected by both Vorderman (1893) and Prillwitz (Hartert, 1902), it was not described as a subspecies until Hoogerwerf (1963b)—notably, each of these collectors struggled to procure a large sample, suggesting that it has always been scarce. Del Hoyo et al. (2020) wrote, without clear justification, that “race *kangeanus* [sic]...is possibly extinct”. Although notably scarcer on Kangean than Laced Woodpecker *Picus vittatus*—which is also far more plastic in habitat use—Javan Flameback does persist on Kangean and Paliat. MI encountered several individuals across both islands, SvB found only a single individual on Paliat (and none on Kangean) and, in June 2023, AJB and CLR found three on Kangean: a female in selectively logged closed-canopy forest and two in heavily degraded open-canopy forest.

In all observations, flamebacks were found in or close to native forest, venturing into mature teak plantations to feed only where adjacent to it (Irham, 2016). Given the small total area of remaining native forest on Kangean (c.40 km²), Paliat (c.5 km²) and neighboring satellite islands (minimal), it is likely that the global population of this taxon is now small. Elsewhere, densities of *Chrysocolaptes* flamebacks in suitable habitat rarely exceed c.4–10 birds/km² (e.g., Yorke, 1984; Sivakumar et al., 2006; Wijesundaral & Wijesundaral, 2014), suggesting that the total population size of *C. s. kangeanensis* is probably in the low hundreds. Selective logging on Kangean may also have reduced the carrying capacity of this species further by removing suitable breeding sites.

Red-breasted Parakeet *Psittacula alexandri* [*kangeanensis] (NT)

Endemic taxon *kangeanensis* present on Kangean and Paliat. Hoogerwerf collected at least nine specimens in 1954 from “near Adjasa” [sic], western Kangean (Sudaryanti et al., 2006), suggesting it was easy to locate at that time. In 2007–2008, MI found this species to be similarly common on Kangean and Paliat in flocks of 3–10 individuals in both teak and natural forest (Irham, 2016). SvB found Red-breasted Parakeets at two sites on Kangean, but not on Paliat. Budiman et al. (2018) did not find it in 2016. By 2023, the species had evidently become much rarer than had been observed 15 years earlier. AJB and CLR found only three or four birds at two sites along Kangean’s central ridge: two (or perhaps three) in an area of overgrown teak

plantation adjacent to (disturbed) native forest and another flying over heavily degraded forest. Given the species' loud vocalizations, and that five dawns and dusks (when parakeets are most active) were spent in suitable habitat, these observations are thought to be an accurate reflection of the taxon's (now low) abundance. Further surveys are urgently needed.

Trapping for the cagebird trade is almost certainly the proximate threat that has driven apparently rapid declines between 2007 and 2023. In 2023, a trapper (pers. comm. to AJB) indicated that it was rare compared to "10 years ago". However, in other conversations, the same trapper's use of "10 years ago" referred to observations made in the mid-2000s. Apparently, a small number of people on Kangean keep this species as a pet (although no caged birds were observed in 2023), but most individuals are exported to mainland Java where this taxon continues to enter the trade with some regularity (J. Menner pers. comm. to AJB).

The secondary threat of selective logging should also be considered a serious risk to this subspecies and may substantially limit recovery even if trapping pressure can be brought under control. In 2023, few large, hollow-bearing trees were left standing in the western half of Kangean's central ridge forest, and the current structure of this forest (open with a ridge line that provides vantage points) lends itself to easy detection of remaining nests. Among Kangean's endemic taxa, this population probably has one of the greatest extirpation potentials and merits urgent conservation action. To the best of our knowledge, there is currently no ex-situ population of *P. a. kangeanensis* being kept for conservation purposes.

Black-naped Oriole *Oriolus chinensis* [insularis*] (LC)**

Endemic taxon *insularis* present on Kangean, Paliat and Sepanjang. This taxon remains relatively common in forested habitats on all main islands and presumably many of their satellites. It is tolerant of modified forest habitats throughout its range (including neighboring Java); hence trapping can be considered the only likely threat. In 2023, three birds were observed in cages in Arjasa, Kangean, which were assumed to be collected from the island. Despite low to moderate trapping pressure, this taxon is probably at low risk of extirpation.

Large-billed Crow *Corvus macrorhynchos* [?] (LC)

Kangean's population is currently included within the nominate subspecies. Hartert (1902) wrote of the single specimen available to him: "It is very doubtful if this specimen is typical *C. macrorhynchos* as the bill is wider at base and proportionally more elongate than in a large series in front of me. Vorderman's measurements ... seem also to indicate a similar bill". Hartert measured 71 mm for culmen, cf. 60–69mm (nominate on mainland Java), which is only surpassed by 70–80 mm (in *japonensis*) and 60–73mm (in *tibetosinensis*). More taxonomic research is needed.

This is a common species on all islands in the archipelago and, with no apparent threats likely to be driving population declines, is probably secure in the near-term.

Bar-bellied Cuckooshrike *Coracina striata* [*vordermani] (LC)

Endemic taxon *vordermani* is present on Kangean, Paliat and Sepanjang. First collected by Prillwitz (Hartert, 1901), who obtained several specimens from across Kangean, leading Hartert (1902) to conclude that it was “not rare”. Similarly, Hoogerwerf reportedly collected it on Kangean, Paliat and Sepanjang (Irham, 2016), suggesting that at one time this species was widespread and perhaps common throughout the islands. West (1980), de Iongh et al. (1982), Nurwatha (1996), Budiman et al. (2018) and AJB/CLR all failed to detect it, but MI observed eight at three sites, all in natural forest and forest edge, while SvB briefly saw one on Paliat and possibly heard another on Sepanjang. This pattern of records suggests that the taxon is scarce but probably continues to be widespread in the remaining stands of native forest.

Hair-crested Drongo *Dicrurus hottentottus* [jentincki] (LC)

Taxon *jentincki* is known from Kangean, Saobi, Paliat and Sepanjang. Although the species—as defined here—is widely distributed across South-East Asia and Wallacea, Eaton et al. (2021) separated ‘Javan Spangled Drongo’ *D. jentincki* on account of morphological and vocal differences. If this split is more widely adopted, Javan Spangled Drongo has a relatively small distribution comprising *jentincki* (East Java, Bali, the Kangean islands, Masalembu and Besar), *faberi* (Panaitan) and *termeuleni* (Seribu) (Eaton et al., 2021), with Kangean as the species’ type locality (Vorderman, 1893). Vocalizations recorded in 2023 appeared similar to those on Java (AJB pers. obs.).

Eaton et al. (2021) wrote that Javan Spangled Drongo occurs in a wide range of habitats on mainland Java and Bali, but “primary forest on small islands”. However, throughout the Kangean archipelago, we observed this species to be common in agricultural landscapes but scarce to absent in the most intact native forests, suggesting that forest loss and degradation on Kangean have probably been to this species’ benefit.

Kangean Tit-babbler *Mixornis prillwitzii* [*] (VU)

Currently the only species of bird considered endemic to the archipelago (but see account for White-rumped Shama below), with records from Kangean and Paliat (*contra* BirdLife International [2023], where it is mapped only for Kangean). It is absent from Saobi (MI), and its status is unknown on other satellites of Kangean/Paliat.

Kangean Tit-babbler has evidently always been widespread and was reported by almost all visitors to the island. Based on the large series of eleven specimens collected by Prillwitz, Hartert (1902) wrote that birds were “all over” Kangean. Irham (2016) similarly found it to be “fairly common in open area, agricultural area and teak forest”. SvB detected them at most sites, and AJB and CLR found them to be one of the most abundant passerines during their four-day visit, second only to Ashy Tailorbird. In three transects of 1.7–2.2 km (2023), 18–22 birds were recorded, while a c.5-km walk yielded another 28 individuals. These counts occurred

in a variety of different wooded habitats, including scrub, overgrown teak plantations, forest edge, and native (but degraded) forest.

The global conservation status of Kangean Tit-babbler is currently evaluated as Vulnerable on the IUCN Red List (BirdLife International, 2016). This assessment was made under Criterion C2a(i), suggesting a declining population smaller than 10,000 mature individuals, with multiple subpopulations, each no larger than 1,000 mature individuals. This is probably an overly precautionary interpretation of its status. In our view, the species is unlikely to be declining given its preference for scrubby habitats and open-canopy forest (native or plantation). While initial clearance of forest for teak plantations may, in the short-term, cause birds to be displaced, Kangean Tit-babblers appear able to thrive in plantations once an understory has developed. Selective logging in native forest is probably also beneficial to this species, as individuals in native forest were noticeably concentrated in open-canopy areas with a thick understory (AJB, CLR). There is no evidence that large-scale forest clearance for agriculture has occurred on Kangean for at least 20 years (Global Forest Watch, 2023), and satellite imagery shows a general trend of recovering scrub on both Kangean and Paliat (Google Earth, 2023). In our view, the near-term extinction risk for this species is very low, although we caution that this should continue to be monitored due to the highly volatile cagebird trade, which can lead to demand for species suddenly and unpredictably increasing (as happened for white-eyes and prinias) (Eaton et al., 2015; Sykes, 2017).

Lemon-bellied White-eye *Zosterops chloris* (LC)

White-eyes throughout Java are under considerable pressure from the bird trade (e.g. van Balen et al., 2023) and therefore any population of white-eye on Kangean merits discussion. Records of Lemon-bellied White-eye from the Kangean archipelago are sporadic and inconsistent, suggesting that they exhibit seasonal movements, probably breeding on small islands and occasionally dispersing to adjacent larger ones. This phenomenon has previously been demonstrated from Bawean (Hoogerwerf, 1966) and north-west Bali (van Balen, 1991). Records of this species in the archipelago are as follows: Hoogerwerf (August/September), West (July), Nurwatha (September), Budiman et al. (November) and SvB (December), but it was not found by Vorderman (May), Hartert (September), de Iongh et al. (May/June), Irham (May–April, June–September, December), or AJB and CLR (June). It is unclear from these records whether the pattern observed is seasonal or idiosyncratic—more research needed.

Ashy Tailorbird *Orthotomus ruficeps* [palliolatus*] (LC)**

Endemic taxon *palliolatus* is present on Kangean and Paliat (also on Karimunjawa). As is typical elsewhere in this species' range, Ashy Tailorbird is a common bird on both islands, where it is feasibly the most abundant passerine; e.g., at least 48 individuals were detected along a c.5-km transect on Kangean (June 2023; AJB, CLR). This species is scarcest in agricultural landscapes and closed-canopy forests, and commonest in scrub and newly

planted teak plantations. Of the 13 endemic taxa on Kangean, this bird is probably at the lowest risk of extinction.

White-rumped Shama *Copsychus malabaricus* [nigricauda*] (LC)**

Endemic taxon *nigricauda* present on Kangean and Paliat. Although considered a subspecies by current global checklists, genomic data (Wu et al., 2022) combined with plumage, mensural and display behavior differences (Collar & Wirth, 2022; Wu et al., 2022; J. Menner in litt., 2023) support the elevation of ‘Kangean Shama *C. nigricauda*’ to species rank.

Shortly after the taxon’s description by Vorderman (1893), Prillwitz procured a large series of 16 specimens (Hartert, 1902). Several decades later, Hoogerwerf collected more specimens from west Kangean and Paliat (Hoogerwerf, 1962a; Irham, 2016). As might be reasonably expected for a species tolerant of disturbed forests (authors pers. obs.), White-rumped Shammas were probably once widespread and easy to find on Kangean. De Iongh et al. (1982) did not report it from their survey, suggesting that by 1980 its abundance and/or range may already have been greatly reduced; however, they also did not report other species expected to be common, including Kangean Tit-babbler, rendering the absence of shama observations difficult to interpret. By the time MI extensively surveyed the islands in 2007–2008, the taxon had evidently declined catastrophically: in several weeks of fieldwork in suitable forest, only a single bird was heard in eastern Kangean (Irham, 2016). Subsequent visits by Budiman et al. (2018), SvB and AJB/CLR were unsuccessful, and the testimony of trappers in 2023 (pers. comm. to AJB) provided strong evidence that the species may now be extirpated from both main islands (see Berryman, 2023). This circumstance mirrors that of several other Indonesian White-rumped Shama taxa, which have been trapped to (near-) extinction in the wild (e.g., Eaton et al., 2015; Rheindt et al., 2019; Wu et al., 2022). Shammas from Kangean are particularly sought-after for their large size, performance of ‘*gembung*’ display and their crossbreeding with other taxa that do not exhibit these characters (especially *C. m. melanurus*) to produce even more desirable hybrids (Menner, 2022; J. Menner in litt., 2023).

In 2021, several birds resembling *C. [m.] nigricauda* appeared in Javan trade, which were collected from another island (name withheld), providing hope that a wild population of Kangean Shammas still persists (but see Berryman [2023] for testimony that even this source may already be on the verge of extirpation). Using these traded birds, an insurance (captive) population has already been established. As noted by Wu et al. (2022), however, confirming that birds in the captive population are a genetic match for true *nigricauda* (i.e. birds from Kangean) is vital before any reintroduction can be considered (which can happen only after trapping pressure has subsided). There is also a need for more extensive surveys on the Kangean islands themselves. During their visits in 2010 and 2023, SvB and AJB/CLR explored a comparatively small area of the western forested ridge on Kangean. While this may prompt hope that a gully further east along the ridge may host a remnant population, we note that walking tracks are pervasive

throughout this forest (Google Earth, 2023), and no remaining area of Kangean's forests is likely remote enough to be free from trapping pressure.

Java Sparrow *Padda oryzivora* (EN)

Present on Kangean and (at least historically) some of its satellites; perhaps more widespread. On Java, this species is subject to intense trapping pressure and is currently considered globally Endangered because of rapid population declines (BirdLife International, 2023). In 2023, it was locally common on Kangean, with one agricultural area (the only one surveyed intensively) yielding a count of at least c.20 individuals (AJB, CLR).

Uncertainty remains over whether Java Sparrow is native to the Kangean islands but given the species' global status (BirdLife International, 2023) and the observation that it remains locally common on the islands, resolving this is of potentially high conservation significance. MacKinnon & Phillipps (1993), Restall (1996) and Islam (2021) all list Kangean as part of the native range of the species, but Keffer (1972) and BirdLife International (2001, 2023) explicitly discount it. Payne (2010) and Eaton et al. (2021) appear to have overlooked its presence on Kangean entirely.

Java Sparrow was present on Kangean (and Sapudi and Sepeken) at the time of its first ornithological exploration in 1892 (Vorderman, 1893). Although it is possible that sparrows were introduced onto the islands (given its status as a species with a long history of trade), as is reported for other islands in the region (e.g. Bawean island), we consider it possible that Kangean does constitute part of the native range. First, although the species was evidently introduced to other areas before the 1890s (BirdLife International, 2001), it is notable that it was not found on Bawean at that time (Vorderman, 1892). Second, unlike Bawean, which is of volcanic origin, the central ridge of Kangean is dominated by karst limestone with fissures and caves (Irham & Marakarmah, 2009), which likely constitutes natural breeding habitat of the species before human colonization of Kangean. Java Sparrow is known to breed in karst hills on Java (e.g. near Gresik, East Java [Kuroda, 1933], and near Ciampea and Cirebon, West Java) (SvB pers. obs.). It is likely that its true status will never be resolved, but we disagree with previous authors who have altogether discounted the possibility of native origin with limited evidence.

Black-faced Munia *Lonchura molucca* [#kangeangensis] (LC)

Found on Kangean, Paliat and Sepanjang, this population was described as an endemic subspecies, *kangeanensis*, by Vorderman (1893). It was later synonymized with *L. m. propinqua* by Paynter (1968), but Restall (1996) commented that Kangean birds are "extremely lightly marked, and merit careful study". This species was observed by most visitors to the archipelago, including MI and SvB, but puzzlingly not AJB or CLR. It nonetheless seems unlikely that this adaptable species, which is highly resilient to trapping pressure elsewhere in Indonesia (authors pers. obs.), is under threat.

Common Hill Myna *Gracula religiosa*

Recorded only from Kangean (n nominate subspecies). Hoogerwerf (1962d) could not find any mensural, bare part or plumage differences between the Kangean specimens he collected (one male, five females) and a larger sample of nominate *religiosa*, but Irham (2016) noted that the vocalizations of Kangean mynas may be distinct. Given its conservation urgency (see below), determining the taxonomic status of this population should be a priority for future research.

The historical abundance of this species on Kangean is poorly known, but by 2007–2008, it had apparently been trapped to near extirpation, with MI’s extensive fieldwork resulting in the observation of only two individuals, both in native forest (Irham, 2016). SvB and Budiman et al. (2018) did not find any in 2010 and 2016 respectively. Encouragingly, AJB and CLR observed a pair in June 2023 in degraded native forest in the center of Kangean.

After White-rumped Shama, it is plausible that Common Hill Myna has the next highest extirpation potential of any species in the Kangean archipelago (Irham, 2016). As with Red-breasted Parakeet, this species is tolerant of forest disturbance elsewhere within its range, implicating trapping pressure for the cagebird trade—which has extirpated several insular hill myna taxa in Indonesia (e.g., Ng et al., 2021)—as the proximate cause of its declines. However, as is also true with the parakeet, Common Hill Myna is a cavity-nesting species, such that the targeting of larger and older trees (which are more likely to host cavities) may disproportionately affect this species and hinder future recovery even if trapping pressure is eased. Although the available data are sparse, the infrequent observations and the relatively small area of remaining habitat suggests that any remnant population on Kangean may be fewer than 100 individuals.

DISCUSSION

We report a total of 140 species from the archipelago, an increase of 27 species from the most recently published inventory (113) (Irham, 2016). Most of these additions were migrants found wintering on Kangean during SvB’s visit to the islands in December 2010. In total, 37 migrant birds are known from the islands, among them 17 shorebirds including the Endangered Far Eastern Curlew *Numenius madagascariensis* and Near Threatened Curlew Sandpiper *Calidris ferruginea*, and eight landbirds, including Kamchatka Leaf-warbler *Phylloscopus examinandus* which is otherwise known wintering in the region only from Bali eastwards (Eaton et al., 2021; SvB pers. obs.).

As is typical of many Indonesian islands, avian diversity in the Kangean archipelago is low but (subspecific) endemism is high: at least 13% of the (presumed) resident species documented here have endemic subspecies. Of these 13 endemic taxa, nine are found on only Kangean and Paliat. In terms of resident species, Sepanjang is the least diverse island, and does not host either Kangean Tit-babbler or ‘Kangean Shama’, both of which have by some authors been treated as species endemic to the archipelago.

The two greatest threats to the birds of the Kangean archipelago are those familiar to broader Indonesian conservation efforts: forest loss and degradation (Brooks et al., 1997) and trapping for the cagebird trade (Nash, 1993; Eaton et al., 2015; Symes et al., 2018). These threats are discussed below in the specific context of the Kangean islands.

Forest loss and degradation

Historically, large areas of the Kangean archipelago were cleared for timber extraction, plantations (particularly teak) and other land-use change, with Irham (2016) noting that in November–December 2010, 4,000 trunks of teak and other tree species were reportedly exported from Kangean every day. This has left only c.13% of Kangean island covered by native forest (Global Forest Watch, 2023), of which almost 40% is mangrove forest (Irham, 2016); almost all remaining (non-mangrove) native forest on Kangean is confined to the central ridge. Although forest clearance on the island now appears minimal and has been since c.2008 (Global Forest Watch, 2023), the ridge forest continues to be subjected to considerable selective logging pressure. In 2023, very few large trees remained on the western side of the ridge forest, and the understory was unnaturally dense and tangled in most areas (AJB, CLR pers. obs.). While these alterations have benefited some species, notably Kangean Tit-babbler, Ashy Tailorbird and Greater Coucal, the large-scale removal of large trees has probably had a considerable impact on hollow-nesting species such as Red-breasted Parakeet, Javan Flameback and Common Hill Myna (see species accounts). This observation is mirrored across the entire Kangean archipelago: using remote sensing data, Grantham et al. (2020) determined that all Kangean’s forests, except perhaps mangroves, are now highly impacted by anthropogenic modification. The impact of this is unclear, but it is well-documented that frugivorous and insectivorous bird species globally respond negatively to selective logging, with some populations not recovering for more than 40 years after logging has ceased (Burivalova et al., 2015).

Trapping

Although forest clearance and degradation have undoubtedly caused declines in many species, the most acute extinction risk for many Kangean birds is trapping. The cagebird trade in Indonesia is a well-documented threat that has caused the extinction and near-extinction of several taxa (e.g., Eaton et al., 2015). Bird-keeping was not nearly as pervasive on Kangean as it is on neighboring Java (authors pers. obs.): although some households on Kangean did have pet birds (in 2023), many of these were common species caught on the island. Most of the trapping pressure on the archipelago, however, is assumed instead to supply the demand on neighboring Java, where an estimated 75 million cagebirds are kept (Marshall et al., 2020). Trapping on Kangean thus appears to be highly selective and to target species for specific markets on Java.

In 2007–2008, trapping pressure was focused on White-rumped Shama, Common Hill Myna and Zebra Dove (Irham, 2016). Acute trapping pressure has evidently continued for the shama and myna, with White-rumped Shama potentially now extirpated, or nearly so,

on Kangean (Berryman, 2023; this study) and Common Hill Myna persists only in very low numbers. However, there has been a remarkable recovery in Zebra Dove numbers (see species account), indicating that for species on Kangean—and Indonesia more broadly—rapid recovery is possible if trapping pressure can be ameliorated. This is most likely to be realized for species that show catholic habitat use, and for which only trapping was instrumental in their declines.

Two species appear to be under greater threat in Kangean than 15 years ago. The risks to Green Junglefowl are evidently more acute now than indicated by Irham (2016), with this species now very rare and potentially at high risk of extirpation. Although two local people in 2023 vouched for their persistence (pers. comm. to AJB, see species account), they were unable to recall seeing or hearing wild junglefowl in the previous two years, and they were not found during either survey effort in 2010 or 2023. Perhaps most concerning, however, is the rapid deterioration in the status of the endemic subspecies of Red-breasted Parakeet, which has apparently declined from being “frequently seen” and “secure” in 2007–2008 (Irham, 2016), to now being rare, heavily trapped and with a perceived high risk of extirpation in the next decade.

Vehicular and walking tracks now permeate all remaining forest on the island (Google Earth, 2023), such that any remaining populations of popular cagebird species cannot be considered secure from trapping pressure (see Harris et al., 2017).

Conservation and future work

The presence and abundance of the species discussed demonstrates the potential (and need) for the Kangean archipelago to be recognized as an area of both regional and global significance for biodiversity. First, as an Important Bird and Biodiversity Area (IBA), Kangean (combined with Paliat) could meet global IBA Criterion A2 (range-restricted species), as it hosts significant populations of both Kangean Tit-babbler and Javan Flameback (BirdLife International, 2020). Additionally, the regional Criterion B1a (presence of several Near Threatened species) is also met. Assessing the importance of Kangean in the context of all global biodiversity (i.e. not just avian taxa; see, e.g., de Iongh et al., 1982) is also likely to qualify Kangean as a Key Biodiversity Area (KBA) for geographically restricted species (Criterion B) (IUCN, 2016). If Kangean Shama is split, the importance of the archipelago for species conservation would only increase.

Currently, the archipelago’s only terrestrial protected area (a cagar alam; 4.3 km²) lies on Saobi and was established in 1919 to protect a population of breeding Orange-footed Scrubfowl and *Manilkara kauki* trees (Appelman, 1938; de Iongh et al., 1982). Given the pattern of species distributions within the Kangean islands, we encourage any future protected area aiming to safeguard endemic taxa to be placed on Kangean, which hosts the largest contiguous area of native forest (c.40 km²). Alongside designation, it will also be necessary to provide resources for effective law enforcement to prevent further illegal logging and control trapping. Notably, the ostensible protection of Saobi’s forests was unable to prevent the near-total clearance of the trees it was established to protect (de Iongh et al., 1982).

Despite our efforts to document the birds of the Kangean archipelago and describe their distribution and status, there remain many notable knowledge gaps. More detailed surveys of White-rumped Shama, Red-breasted Parakeet, Common Hill Myna and Javan Flameback should be considered a high priority, particularly aiming to explore the eastern ridge forests of Kangean island, which have not been ornithologically explored since 2007–2008 (Irham, 2016). These surveys should seek to determine whether any population of White-rumped Shama on the islands does persist, and also be more systematic in methods than surveys described herein to help clarify population sizes for the islands' endemic taxa. Only then will we have a more complete understanding of the plight facing Kangean's forest birds.

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APPENDIX. Complete list of bird species recorded in the Kangean archipelago, Indonesia. Taxonomy follows BirdLife International (2023). IUCN = IUCN Red List status 2023 (BirdLife International 2023), where LC = Least Concern, NT = Near Threatened, VU = Vulnerable, EN = Endangered, CR = Critically Endangered. Status = R (Resident), M (Migrant) or I (Introduced). Greyed rows are species that have been reported but we consider unconfirmed. * Denotes species with taxa endemic to the archipelago. All data from Raas and Sapudi are from Vorderman (1893). The sources AJB, CLR, SvB and MI are the authors of the present study.

Confirmed species				Source										Distribution					
English name	Scientific name	IUCN	Status	Vorderman	Prillwitz	Hoogerwerf	West	Tongh et al.	Nurwatha	Budinman et al.	MI	SvB	AJB & CLR	Kangean	Palat	Sepanjang	Sepeken	Raas	Sapudi
				Orange-footed Scrubfowl	<i>Megapodius reinwardt</i>	LC	R	X	X			X			X	X		?	X
Green Junglefowl	<i>Gallus varius</i>	LC	R	X	X		X	X	X		X			X					
Wandering Whistling-duck	<i>Dendrocygna arcuata</i>	LC	R			X				X	X			X	X	X			
Lesser Whistling-duck	<i>Dendrocygna javanica</i>	LC	R		X	X					X	X		X	X	X			
Pacific Black Duck	<i>Anas superciliosa</i>	LC	R		X	X		X						X					
Sunda Teal	<i>Anas gibberifrons</i>	NT	R				X				X	X		X	X				
Sunda Collared Dove	<i>Streptopelia bitorquata</i>	LC	R						X	X									X
Eastern Spotted Dove	<i>Spilopelia chinensis</i>	LC	R	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X
Ruddy Cuckoo-dove	<i>Macropygia emiliana</i>	LC	R*	X	X		X	X			X	X	X	X	X				
Zebra Dove	<i>Geopelia striata</i>	LC	R	X	X		X			X	X		X	X				X	X
Nicobar Pigeon	<i>Caloenas nicobarica</i>	NT	R	X	X									X		X			
Grey-capped Emerald Dove	<i>Chalcophaps indica</i>	LC	R	X	X			X	X		X	X	X	X	X	X			
Pink-necked Green-pigeon	<i>Treron vernans</i>	LC	R	X	X	X	X		X		X	X	X	X	X				X
Grey-checked Green-pigeon	<i>Treron griseicauda</i>	LC	R*	X	X		X	X			X	X		X	X				
Green Imperial-pigeon	<i>Ducula aenea</i>	NT	R				X	X	X		X	X	X	X	X				
Pink-headed Imperial-pigeon	<i>Ducula rosacea</i>	NT	R	X	X				X				?	X	?				
Pied Imperial-pigeon	<i>Ducula bicolor</i>	LC	R		X		X	X	X	X	X	X	X	X	X	X			
Black-naped Fruit-dove	<i>Ptilinopus melano-spilus</i>	LC	R		X				X		X	X	X	X	X	X			
Sunda Frogmouth	<i>Batrachostomus cornutus</i>	LC	R*								X		X	X	?	X			
Grey-rumped Treeswift	<i>Hemiprocne longipennis</i>	LC	R								X	X	X	X					
Brown-backed Needletail	<i>Hirundapus giganteus</i>	LC	R?									X		X					
Cave Swiftlet	<i>Collocalia linchi</i>	LC	R	X	X		X	X	X	X	X	X	X	X					X

Confirmed species				Source										Distribution					
English name	Scientific name	IUCN	Status	Vorderman	Prillwitz	Hoogerwerf	West	Longh et al.	Nurwatha	Budiman et al.	MI	SyB	AJB & CLR	Kangean	Paliat	Sepanjang	Sepeken	Raas	Sapudi
Edible-nest Swiftlet	<i>Aerodramus fuciphagus</i>	LC	R		X		X	X	X	X	X	X	X	X	X	X		X	
Asian Palm-swift	<i>Cypsiurus balasiensis</i>	LC	R						X			X			X	X			
Pacific Swift	<i>Apus pacificus</i>	LC	M									X			X				
House Swift	<i>Apus nipalensis</i>	LC	R							X		X	X	X					
Greater Coucal	<i>Centropus sinensis</i>	LC	R*	X	X			X	X	X	X	X	X	X	X	X			
Lesser Coucal	<i>Centropus bengalensis</i>	LC	R						X			X		X	X				
Green-billed Malkoha	<i>Phaenicophaeus tristis</i>	LC	R*	X	X						X		X	X	X				
Western Koel	<i>Eudynamis scolopaceus</i>	LC	R		X						X	X	X	X		X			
Horsfield's Bronze-cuckoo	<i>Chalcites basalis</i>	LC	M	X	X								X	X					
Slaty-breasted Rail	<i>Lewinia striata</i>	LC	R										X	X					
White-breasted Waterhen	<i>Amaurornis phoenicurus</i>	LC	R		X		X	X	X	X	X	X	X	X	X	X			
White-browed Crane	<i>Amaurornis cinerea</i>	LC	R		X							X		X		X			
Watercock	<i>Gallixrex cinerea</i>	LC	M									X				X			
Purple Swamphen	<i>Porphyrio porphyrio</i>	LC	R		X									X					
Common Moorhen	<i>Gallinula chloropus</i>	LC	R		X							X		X		X			
Streaked Shearwater	<i>Calonectris leucomelas</i>	NT	M									X							
Lesser Adjutant	<i>Leptoptilos javanicus</i>	VU	M						X					X					
Glossy Ibis	<i>Plegadis falcinellus</i>	LC	M			X								X					
Yellow Bittern	<i>Ixobrychus sinensis</i>	LC	R									X				X			
Cinnamon Bittern	<i>Ixobrychus cinnamomeus</i>	LC	R		X		X				X	X		X		?			
Black-crowned Night-heron	<i>Nycticorax nycticorax</i>	LC	R		X		X							X					
Green-backed Heron	<i>Butorides striata</i>	LC	R		X			X	X	X	X	X	X	X	X				X
Javan Pond-heron	<i>Ardeola speciosa</i>	LC	R	X	X		X	X	X	X	X	X	X	X	X	X	X		
Cattle Egret	<i>Bubulcus ibis</i>	LC	R				X	X			X	X	X	X	X	X			X
Grey Heron	<i>Ardea cinerea</i>	LC	R				X			X				X					
Great-billed Heron	<i>Ardea sumatrana</i>	LC	R						X	X	X	X		X	X	X			
Purple Heron	<i>Ardea purpurea</i>	LC	R	X	X		X	X	X	X	X	X	X	X	X	X			
Great White Egret	<i>Ardea alba</i>	LC	R										X	X					
Intermediate Egret	<i>Ardea intermedia</i>	LC	R	X	X		X	X		X				X					X
Little Egret	<i>Egretta garzetta</i>	LC	R	X			X			X	X	X	X	X	X		X		
Pacific Reef-egret	<i>Egretta sacra</i>	LC	R		X		X	X	X	X	X	X		X		X			

Confirmed species				Source										Distribution						
English name	Scientific name	IUCN	Status	Vordermann	Prillwitz	Hoogerwerf	West	Longh et al.	Nurwartha	Budiman et al.	MI	SVB	AJB & CLR	Kangean	Paliat	Sepanjang	Sepeken	Raas	Sapudi	
Lesser Frigatebird	<i>Fregata ariel</i>	LC	M	X					X	X										
Great Frigatebird	<i>Fregata minor</i>	LC	M								X									
Christmas Island Frigatebird	<i>Fregata andrewsi</i>	VU	M							X	X									
Little Black Cormorant	<i>Phalacrocorax sulcirostris</i>	LC	R				X		X					X						
Beach Thick-knee	<i>Esacus magnirostris</i>	NT	R	X		X						X		X		X				
Black-winged Stilt	<i>Himantopus himantopus</i>	LC	M				X							X						
Grey Plover	<i>Pluvialis squatarola</i>	LC	M									X							X	
Pacific Golden Plover	<i>Pluvialis fulva</i>	LC	M	X								X		X		X				
Little Ringed Plover	<i>Charadrius dubius</i>	LC	M	X										X						
Javan Plover	<i>Charadrius javanicus</i>	LC	R			X				X		X	X	X						
Malay Plover	<i>Charadrius peronii</i>	NT	R	X										X						
Greater Sandplover	<i>Charadrius leschenaultii</i>	LC	M	X										X						
Whimbrel	<i>Numenius phaeopus</i>	LC	M	X				X	X	X	X	X	X	X	X	X	X			
Far Eastern Curlew	<i>Numenius madagascariensis</i>	EN	M							X				X						
Bar-tailed Godwit	<i>Limosa lapponica</i>	LC	M							X				X						
Godwit sp.	<i>Limosa sp.</i>	NA	M								X									
Curlew Sandpiper	<i>Calidris ferruginea</i>	NT	M							X				X						
Sanderling	<i>Calidris alba</i>	LC	M							X				X						
Snipe sp. (Pintailed/Swinhoe's)	<i>Gallinago sp.</i>	LC	M									X							X	
Common Sandpiper	<i>Actitis hypoleucos</i>	LC	M						X	X	X	X				X	X			
Grey-tailed Tattler	<i>Tringa brevipes</i>	NT	M	X						X	X	X		X					X	
Common Greenshank	<i>Tringa nebularia</i>	LC	M							X	X									
Wood Sandpiper	<i>Tringa glareola</i>	LC	M	X		X				X	X			X					X	
Oriental Pratincole	<i>Glareola maldivarum</i>	LC	M									X			X	X				
Little Tern	<i>Sternula albifrons</i>	LC	R				X		X	X			X	X						
Black-naped Tern	<i>Sterna sumatrana</i>	LC	R	X		X				X										
Lesser Crested Tern	<i>Thalasseus bengalensis</i>	LC	M					X	X	X		X								
Greater Crested Tern	<i>Thalasseus bergii</i>	LC	R	X					X	X	X			X	X	X				
Jaeger sp.	<i>Stercorarius sp.</i>	NA	M									X								
Common Barn-owl	<i>Tyto alba</i>	LC	R	X				X	X	X	X	X	X	X	X	X	X			
Sunda Scops-owl	<i>Otus lempiji</i>	LC	R*	X		X	X	X	X	X		X	X	X						

Confirmed species				Source										Distribution					
English name	Scientific name	IUCN	Status	Vorderman	Prillwitz	Hoogerwerf	West	Tongh et al.	Nurwartha	Budiman et al.	MI	SVB	AJB & CLR	Kangean	Paliat	Sepanjang	Sepeken	Raas	Sapudi
Black-winged Kite	<i>Elanus caeruleus</i>	LC	R			X			X	X	X			X	X	X			
Oriental Honey-buzzard	<i>Pernis ptilorhynchus</i>	LC	M							X	X			X	X				
Changeable Hawk-eagle	<i>Nisaetus cirrhatus</i>	LC	R								X			X					
Black Eagle	<i>Ictinaetus malaiensis</i>	LC	/							X									
Chinese Sparrowhawk	<i>Accipiter soloensis</i>	NA	M									X		X					
White-bellied Sea-eagle	<i>Haliaeetus leucogaster</i>	LC	R		X		X	X		X	X	X	X	X					
Brahminy Kite	<i>Haliastur indus</i>	LC	R	X	X		X	X	X	X	X	X	X	X	X	X	X		
Chestnut-headed Bee-eater	<i>Merops leschenaulti</i>	LC	R						X					X					
Blue-tailed Bee-eater	<i>Merops philippinus</i>	LC	M?		X		X			X	X	X		X	X	X			
Rainbow Bee-eater	<i>Merops ornatus</i>	LC	M								X			X	X				
Oriental Dollarbird	<i>Eurystomus orientalis</i>	LC	R		X							X		X					
Rufous-backed Dwarf-kingfisher	<i>Ceyx rufidorsa</i>	LC	R	X	X		X							X					
Blue-eared Kingfisher	<i>Alcedo meninting</i>	LC	R	X			X		X					X					X
Cerulean Kingfisher	<i>Alcedo coerulescens</i>	LC	R	X	X				X	X	X	X	X	X					X
Collared Kingfisher	<i>Todiramphus chloris</i>	LC	R						X	X	X	X	X	X	X				
Sacred Kingfisher	<i>Todiramphus sanctus</i>	LC	M	X	X		X	X	X	X	X		X	X					X X
Javan Flameback	<i>Chrysocolaptes strictus</i>	VU	R*	X	X	X					X	X	X	X	X				
Common Flameback	<i>Dinopium javanense</i>	LC	/						X					X					
Laced Woodpecker	<i>Picus vittatus</i>	LC	R	X	X			X	X		X	X	X	X	X				
Spotted Kestrel	<i>Falco moluccensis</i>	LC	R	X	X				X		X	X	X	X	X				
Red-breasted Parakeet	<i>Psittacula alexandri</i>	NT	R*	X	X		X	X	X		X	X	X	X	X				
Black-naped Oriole	<i>Oriolus chinensis</i>	LC	R*	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X X
Mangrove Whistler	<i>Pachycephala cinerea</i>	LC	R		X						X	X		X		X			
Bar-bellied Cuckoo-shrike	<i>Coracina striata</i>	LC	R*	X	X	X					X	X		X	X	X			
Triller sp.	<i>Lalage cf sueurii</i>	LC	R						X	X			X	X					

Confirmed species				Source										Distribution						
English name	Scientific name	IUCN	Status	Vorderman	Prillwitz	Hoogerwerf	West	Tongh et al.	Nurwartha	Budiman et al.	MI	SVB	AJB & CLR	Kangean	Paliat	Sepanjang	Sepeken	Raas	Sapudi	
White-breasted Woodswallow	<i>Artamus leucorhynchus</i>	LC	R	X	X	X	X	X	X	X	X	X	X	X	X	X				
Common Iora	<i>Aegithina tiphia</i>	LC	/							X				X						
Sunda Pied Fantail	<i>Rhipidura javanica</i>	LC	R							X				X						X
Hair-crested Drongo	<i>Dicrurus hottentottus</i>	LC	R	X	X	X	X	X	X		X	X	X	X	X	X	X			
Brown Shrike	<i>Lanius cristatus</i>	LC	R									X		X						
Long-tailed Shrike	<i>Lanius schach</i>	LC	R		X		X				X			X					X	X
Slender-billed Crow	<i>Corvus enca</i>	LC	/							X				X						
Large-billed Crow	<i>Corvus macrorhynchos</i>	LC	R	X	X	X	X	X	X		X	X	X	X	X	X	X		X	X
Zitting Cisticola	<i>Cisticola juncidis</i>	LC	R		X		X	X	X		X	X	X	X	X	X				
Bar-winged Prinia	<i>Prinia familiaris</i>	NT	R							X										X
Plain Prinia	<i>Prinia inornata</i>	LC	/							X				X						
Ashy Tailorbird	<i>Orthotomus ruficeps</i>	LC	R*	X	X		X	X	X		X	X	X	X	X					
Olive-backed Tailorbird	<i>Orthotomus sepium</i>	LC	/							X				X						
Clamorous Reed-warbler	<i>Acrocephalus sten-toreus</i>	LC	/							X				X						
Red-rumped Swallow	<i>Cecropis daurica</i>	LC	R							X										
House Swallow	<i>Hirundo javanica</i>	LC	R	X	X		X	X	X	X	X	X		X		X				
Barn Swallow	<i>Hirundo rustica</i>	LC	R				X				X	X								
Sooty-headed Bulbul	<i>Pycnonotus aurigaster</i>	LC	/							X				X						
Yellow-vented Bulbul	<i>Pycnonotus goiavier</i>	LC	R	X	X		X	X	X		X	X	X	X	X					
Arctic Warbler	<i>Phylloscopus borealis</i>	LC	M								X	X					X			
Kamchatka Leaf-warbler	<i>Phylloscopus examinandus</i>	LC	M												X	X				
Lemon-bellied White-eye	<i>Zosterops chloris</i>	LC	R				X	X	X			X			X	X				
Kangean Tit-babbler	<i>Mixornis prillwitzii</i>	VU	R*	X	X	X		X		X	X	X	X	X	X					
Javan Pied Starling	<i>Gracupica jalla</i>	CR	R																	X
Black-winged Myna	<i>Acridotheres melanopterus</i>	EN	R																	X
Common Hill Myna	<i>Gracula religiosa</i>	LC	R		X		X			X		X	X							
Asian Glossy Starling	<i>Aplonis panayensis</i>	LC	R																	X
White-rumped Shama	<i>Copsychus malabaricus</i>	LC	R*	X	X	X					X			X						
Asian Brown Flycatcher	<i>Muscicapa dauurica</i>	LC	M									X		X						

Confirmed species				Source										Distribution					
English name	Scientific name	IUCN	Status	Vorderman	Prillwitz	Hoogerwerf	West	Lough et al.	Nurwartha	Budiman et al.	MI	SVB	AJB & CLR	Kangean	Paliat	Sepanjang	Sepeken	Raas	Sapudi
Orange-bellied Flowerpecker	<i>Dicaeum trigonostigma</i>	LC	/							X				X					
Scarlet-headed Flowerpecker	<i>Dicaeum trochileum</i>	LC	R	X	X		X	X	X	X	X	X	X	X	X	X			
Brown-throated Sunbird	<i>Anthreptes malacensis</i>	LC	R	X	X		X	X	X	X	X	X	X	X	X		X		X
Olive-backed Sunbird	<i>Cinnyris jugularis</i>	LC	R	X	X		X		X	X	X	X	X	X	X	X	X		
Black-faced Munia	<i>Lonchura molucca</i>	LC	R	X	X		X		X		X			X	X	X	X		
Scaly-breasted Munia	<i>Lonchura punctulata</i>	LC	R				X		X		X	X	X	X	X				
White-headed Munia	<i>Lonchura maja</i>	LC	R				X						X	X					
Java Sparrow	<i>Padda oryzivora</i>	EN	R (I?)	X	X						X		X	X			X		X
Eurasian Tree Sparrow	<i>Passer montanus</i>	LC	R (I)				X	X				X	X	X					X
													Total	110	57	54	9	7	19