

Trade-driven extinctions and near-extinctions of avian taxa in Sundaic Indonesia

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Commercial trade, almost always for pets, represents a major threat to bird species and subspecies in Sumatra, Kalimantan, Java and Bali, Indonesia. Thirteen species—Silvery Woodpigeon *Columba argentina*, Javan Hawk-eagle *Nisaetus bartelsi*, Helmeted Hornbill *Rhinoplax vigil*, Yellow-crested Cockatoo *Cacatua sulphurea*, Scarlet-breasted Lorikeet *Trichoglossus forsteni*, Javan Green Magpie *Cissa thalassina*, Black-winged Myna *Acridotheres melanopterus*, Bali Myna *Leucopsar rothschildi*, Straw-headed Bulbul *Pycnonotus zeylanicus*, Javan White-eye *Zosterops flavus*, Rufous-fronted Laughingthrush *Garrulax rufifrons*, Sumatran Laughingthrush *Garrulax bicolor* and Java Sparrow *Lonchura oryzivora*—are identified as at greatly elevated risk of global extinction from trade pressures, plus the nominate Javan race of Crested Jay *Platylophus galericulatus*, the races *tricolor*, *hypolizus*, *opisthochrus*, *melanurus*, *omissus* and *barbouri* of White-rumped Shama *Copsychus malabaricus*, race *jalla* of Asian Pied Starling *Gracupica contra*, races *miotera*, *robusta* and (extralimital) *venerata* of Hill Myna *Gracula religiosa*, and races *rookmakeri* and *laurinae* of Silver-eared Mesia *Leiothrix argentea*. Scarlet-breasted Lorikeet *Trichoglossus forsteni* race *djampeanus*, White-rumped Shama *Copsychus malabaricus* races *opisthochrus*, *omissus* and *nigricauda* and Hill Myna *Gracula religiosa* race *miotera* may already be extinct. However, this is a conservative list because (a) some candidates simply lack information to indicate trade as a threat, (b) taxonomic revision will probably increase the number of full species at risk from trade, and (c) taxonomically undifferentiated populations were not included in this review. As certain favoured species disappear, others are targeted as next-best substitutes (e.g. Grey-cheeked Bulbul *Alphoixus bres* for Straw-headed Bulbul *Pycnonotus zeylanicus*), and commercial breeders may hybridise taxa for better effects (e.g. non-Indonesian subspecies of Asian Pied Starling *Gracupica contra* with Indonesian race *jalla*). Law enforcement, public awareness campaigns, *in situ* management, conservation breeding, conversion of trappers to wardens and field, market and genetic surveys are all needed, but commercial breeding, while attractive in theory, presents difficulties that are probably insurmountable in practice.

INTRODUCTION

There is growing concern over the impact of commercial trade (for pets, food, ornaments and medicines) on animal populations in South-East Asia, and over the number of species being pushed towards extinction as a consequence (Nijman 2010, Duckworth *et al.* 2012). Populations of numerous vertebrate taxa from fish to mammals are in serious decline in the wild owing to the pressure exerted on them by illegal and/or unsustainable legal trade, compounded by unchecked demand, weak legislation, lax enforcement, institutional indifference and systemic corruption (Nijman 2010). Birds are reportedly the most traded among the higher classes of animals (Bush *et al.* 2014), and Indonesia, with its long tradition of bird-keeping (Jepson & Ladle 2005) and its high levels of biological diversity already under great pressure from habitat loss (Myers *et al.* 2000), holds the greatest number of globally threatened bird species for which trade is registered as a significant threat—28, with Brazil following at 24 and China at 18 (A. Symes *in litt.* 2015).

In recent years some first steps have been taken to document the scale of the bird trade in Sundaic Indonesia (Jepson & Ladle 2005, Chng *et al.* 2015) and its impact on some species (Shepherd 2006, 2007, 2011, Chng *et al.* 2015, Harris *et al.* 2015, Shepherd *et al.* 2015), as well as to provide a safeguard against the extinction of some of these species through the establishment of *ex situ* breeding populations (Collar *et al.* 2012, Owen *et al.* 2014). These initiatives have been largely extemporary in nature, with the *ex situ* work in particular driven by alarm and opportunity, much of it led by what is now called the Threatened Asian Songbird Alliance (TASA), operating as a formal body of the European Association of Zoos and Aquaria (EAZA). Here, therefore, we seek to assemble and assess the evidence to provide an overview of how serious trade is as an existential threat to avian taxa in Sundaic Indonesia.

METHODS

By trade we mean both domestic and international, but in this paper the focus is almost entirely on domestic commerce, almost

entirely for pets. By ‘Sundaic’ Indonesia we mean Sumatra, Java, Bali and Indonesian Borneo (Kalimantan) and the islands that are biogeographically associated with them; these are largely the focus of the bird trade in Indonesia (Nash 1993, Shepherd *et al.* 2004). We exclude Wallacea and West Papua from consideration here, although these regions also experience significant pressure from the bird trade, notably in parrots (see, e.g., Smiet 1985, Inskipp *et al.* 1988, Lambert 1993, Pangau-Adam & Noske 2010), but we include certain cases where the ‘Sundaic’ species under consideration have populations or subspecies present in Wallacea.

We provide brief outlines of the situation of each taxon from a patchwork of sources involving published and unpublished writings, the CITES trade database, market observations, personal records in the wild, and correspondence and conversations with other ornithologists and birdwatchers. Our conclusions—including the selection of taxa for treatment in the present paper—largely derive from a combination of our own collective experience and knowledge with those of others working on birds in the region. We also benefited from the judgement and information of the 35 international experts (including authors JAE, CRS, FER and NJC) who attended the first Asian Songbird Crisis Summit, held in Singapore, September 2015, to discuss and formulate plans to respond to trade-driven population crashes.

Taxonomy, sequence and geographical distribution follow del Hoyo & Collar (2014) for non-passerines and Inskipp *et al.* (1996) for passerines, except that in the latter case (a) we accept species status for Javan Green Magpie *Cissa thalassina* (van Balen *et al.* 2013) and Sumatran Laughingthrush *Garrulax bicolor* (Collar 2006), (b) we acknowledge that ‘Black-winged Starling *Sturnus melanopterus*’ is an *Acridotheres* myna and that ‘Asian Pied Starling *Sturnus contra*’ belongs in the genus *Gracupica* (Feare & Craig 1998, Lovette *et al.* 2008, Zuccon *et al.* 2008) and (c) we use other sources to supplement distributional information.

Information based on our own fieldwork and deriving from our own enquiries is credited to the relevant author’s initials. We present the results in taxonomic sequence of species, with subspecies treated under the parent species, and the current IUCN threat status is given in abbreviated form (CR = Critically Endangered, EN =

Endangered, VU = Vulnerable, NT = Near Threatened and LC = Least Concern). NP stands for National Park.

RESULTS

In this review we identify 13 species in Sundaic Indonesia that we believe to be at risk of global extinction with trade as the major threat; in the case of four of these species, 11 subspecies are recognised, all of which are necessarily also threatened. We also identify 14 further subspecies (marked *) that we suspect on the evidence we muster probably to be at risk of global extinction from the same cause but which belong to five species that are globally (relatively) secure (IUCN Least Concern). Regrettably five subspecies—Scarlet-breasted Lorikeet *Trichoglossus forsteni djampeanus*, White-rumped Shama *Copsychus malabaricus opisthochrus*, *C. m. omissus*, *C. m. nigricauda* and Hill Myna *Gracula religiosa miotera*—are probably already extinct, at least in the wild, due primarily to trade (although the *Trichoglossus* evidently suffered also from habitat loss).

Silvery Pigeon *Columba argentina* (CR)

This species is historically known from a small number of locations on or islands associated with Sumatra and Borneo, including the South China Sea (Yong 2009); fewer than 50 mature individuals are estimated to survive (BirdLife International 2015). Without providing details, Nash (1993) reportedly observed birds in trade in Indonesia and Singapore in 1991–1993. However, the factors that have brought it to its current IUCN status were not thought to include trade (BirdLife International 2001), and the species was only rediscovered this century after a 75-year absence of records (Lee *et al.* 2009, Eaton & Roussow 2011). However, the near-simultaneous appearance on the internet of an image taken in July 2000 by Crimson Lam, an aviculturist (http://www.borneobirdimages.com/bird/silvery_pigeon/6147#navigation), of two birds in a Hong Kong aviary prompted concern that trade might compound the difficulties the species faces (Lee *et al.* 2009). Certainly on present evidence, with only a few sites known and tiny numbers at each, trade could easily cause insular extinctions and quickly lead to global extinction.

Javan Hawk Eagle *Nisaetus bartelsi* (EN)

This raptor, known from over 60 forested sites on Java from Ujung Kulong (far west) to Alas Purwo (far east), is threatened by habitat loss and trade, with 30–40 individuals, conceivably equivalent to the species's annual output, being taken each year (BirdLife International 2001). Only 300–500 mature individuals are estimated to survive (BirdLife International 2015), although new sites for the species have been found on Java, perhaps as escapes—reflecting the intensity of trade, which has taken birds to Lombok (Nijman *et al.* 2009); in recent years it has also been seen on Bali (Mason 2011, SvB). Fears that the elevation of the species in 1993 to 'national bird' (with special protection status) would actually stimulate rather than stifle demand for birds (BirdLife International 2001) proved well-founded, with surveys in the 1990s and 2000s showing an increase in zoo holdings (resulting from confiscations) and the commercial availability of the species (Nijman *et al.* 2009). Given that relatively little deforestation is currently occurring on Java (Miettinen *et al.* 2011), trade in the Javan Hawk Eagle is almost certainly the most serious modern threat to the species.

Helmeted Hornbill *Rhinoplax vigil* (CR)

Restricted to the Thai-Malay Peninsula, Sumatra and Borneo, this is the only hornbill species whose casque is solid keratin and therefore carvable. A sudden and unexpected revival of demand in China for its 'ivory', beginning around 2011, has triggered an extremely rapid

and widespread decline in its Indonesian populations (Sumatra and Kalimantan) (Collar 2015a). Organised crime is believed to be operating networks of hunters who are prepared to shoot any large hornbill in the hope that it is this species (BirdLife International 2015, Collar 2015a,b, Beastall *et al.* in press). Between March 2012 and August 2014, heads and casques of 2,170 Helmeted Hornbills were seized in China (1,117) and Indonesia (1,053) (Beastall *et al.* in press), which indicates the scale of the trade (although probably only 'the tip of the iceberg'). As a result, the extinction of the species from Indonesian territory must be contemplated unless major conservation interventions now being evaluated and developed prove successful.

Yellow-crested Cockatoo *Cacatua sulphurea* (CR)

This species is essentially Wallacean, but it is known from two areas in Sundaic Indonesia as we define it. The catastrophic decline of the species throughout its range is—as its recovery on Sumba following international curbs in 1994 indicates (Cahill *et al.* 2006)—almost entirely due to trade (BirdLife International 2001).

Taxon *abbotti* (Masalembu and Masakambing, south of Borneo). This form was present on Masalembu in 'hundreds' a century ago, but is now extinct there; and it just survives on Masakambing, where 8–10 were present in 1994, and 13 in 2011 (BirdLife International 2001, Collar & Marsden 2014). The near-destruction of the subspecies dates back to the 1980s, when palm oil plantation workers on Masalembu either shot birds for sport or exported them as souvenirs, while simultaneously on Masakambing 'hundreds' were caught and exported by gangs of trappers from Bali and Ujung Pandang (Cahyadin *et al.* 1994); pressure was compounded by fishermen from Sumbawa (Metz *et al.* 2009). Today the remnant population is probably too small for traders to target, but if numbers improve in response to current conservation measures, this cannot be ruled out in the future.

Taxon *occidentalis* (Bali, Nusa Penida, and the Lesser Sundas chain from Lombok to Alor: Collar & Marsden 2014). On Bali it was recorded in the late nineteenth century and subsequently as a presumed visitor (BirdLife International 2001). On the adjacent small island of Penida, birds were reported from 1911 and recorded from the 1930s; this population was trapped partly (reportedly) in response to its impact on maize crops, although the birds' high market prices could equally explain the trapping pressure (Setiawan 1996, BirdLife International 2001). In April 2015, a single bird was thought to survive from a small population of unknown origin on Penida (S. Jones *per* C. R. Trainor *in litt.* 2015). If trapping—apparently still rampant (JBCH)—explains the loss of recently released Bali Mynas from Penida (see below), any remaining cockatoos would be targeted opportunistically.

Scarlet-breasted Lorikeet *Trichoglossus forsteni* (NT)

This newly defined species (del Hoyo & Collar 2014) occurs in four subspecies, all in Indonesia and although Lombok, Sumbawa and the Tanahjampea Islands are outside 'Sundaic Indonesia', they are included here for completeness.

Taxon *mitchelli* (Bali and Lombok). Reportedly common on Bali above 1,300 m in the 1910s and 1920s (Stresemann 1913, Rensch 1930) but, following years of exploitation which brought large numbers to Europe (R. Wüst *in litt.* 2015), it can no longer be found despite repeated searches (T. Arndt *per* R. Wirth verbally 2015). However, on Lombok, where its survival was in doubt owing to lack of records for many years, a flock of 18 was found above 1,500 m on Gn Rinjani in September 2015 (FER). Captive populations are reported to exist at Prague and Plzen Zoos (Czech Republic), Birdworld and Paradise Park (UK), the Begawan Foundation (Bali), and the private collections of a few German breeders (R. Wirth and R. Wüst *in litt.* 2015), but the characters that define this taxon need to be carefully re-examined.

Taxon *forsteni* (Sumbawa). The fact that large numbers would appear annually for a few weeks on the Sembalun plateau (Rensch 1931) suggests that status assessments might be liable to major bias depending on encounter. However, limited modern evidence (Trainor 2002a) suggests this form may be secure. Several small flocks were found visiting flowering trees daily in the foothills of a forested mountain (identity withheld), 2–4 September 2008 (F. Verbelen *in litt.*).

Taxon *djampeanus* (Tanahjampea, Flores Sea). ‘Trapped almost to extinction on Tanahjampea’ by the early 1990s (Dutson 1995), the taxon was not found in three visits to the island in October 2011, October 2013 and October 2014 (F. R. Lambert verbally 2014, JAE), and it must be presumed extinct there. According to residents, although formerly common, it disappeared ten years ago, apparently owing to the felling of the large trees in which it nested (Bashari & Arndt *in prep.*). On Kalao, unconfirmed reports by residents stated that the species, while still present in the western forest, was now absent from the drier eastern forest (T. Arndt and H. Bashari *in litt.* 2015).

Taxon *stresemanni* (Kalaotoa, Flores Sea). Two were heard during a brief visit, 23 September 1993 (Dutson 1995). Apparently no subsequent visits have been made but, in the light of what we know of the other subspecies, we cannot assume it is secure.

Crested Jay *Platylophus galericulatus* (LC)

A near-endemic to the Greater Sunda region, this species is found from just north of and throughout the Thai-Malay Peninsula (subspecies *malaccensis*), Sumatra and northern Borneo (*lemprieri*), the remainder of Borneo (*coronatus*), and Java (n nominate) (Madge 2009). It appears that all taxa persist in moderate numbers except for the nominate.

Taxon *galericulatus** (Java). This form, considered ‘not uncommon’ two decades ago (MacKinnon & Phillipps 1993), is now rarely recorded in the wild (SvB, JAE), to the point where it is regarded as ‘almost extinct’ (R. Sözer *in litt.* 2015); in recent years it has only been sighted in one national park, Gn Halimun-Salak (SvB, JAE). In the five years 1997–2001, nine birds were recorded in the bird markets of Medan, North Sumatra (Shepherd *et al.* 2004), and in weekly surveys of the same markets, July–September 2012, seven birds were recorded (Giyanto *in litt.* 2014). The above evidence may indicate a small surplus over demand on Java, but during surveys of the three largest Jakarta bird markets in 2014 eight *coronatus* and no *galericulatus* were observed (Chng *et al.* 2015), and a survey of East Javan bird markets in 2015 produced seven *coronatus* and only one *galericulatus* (Chng & Eaton *in prep.*). In bird markets, *galericulatus* has evidently virtually disappeared, being generally substituted by the form *coronatus*.

Javan Green Magpie *Cissa thalassina* (CR)

This corvid was recognised only in 2013 as specifically distinct from Bornean Green Magpie *C. jefferyi* (montane Borneo) and simultaneously documented as in grave danger of extinction owing to trade pressure (van Balen *et al.* 2013); it is known from 18 localities in the West and Central Javan mountains from Gn Halimun east to Gn Merapi. In direct response to van Balen *et al.* (2013), TASA initiated a programme of captive breeding, seeking whatever birds could still be found in Javan bird markets and maintaining them initially at Cikananga Wildlife Center, Sukabumi, Java (Collar *et al.* 2012, Owen *et al.* 2014). In late 2015, the captive population was divided up for security and propagation, and in January 2016 it comprised five males and 11 females (Cikananga), two pairs (Taman Safari, Bogor, Java), four pairs (Chester Zoo, UK), one pair (Durrell Wildlife Preservation Trust, Jersey, UK) and one pair (Prague Zoo, Czech Republic) (A. Owen *in litt.* 2016). It is conceivable that this *ex situ* population outnumbers the *in situ*. Evidence that the species persists in the wild comes from its occasional presence

in urban bird markets or in roadside cages (R. Sözer verbally 2015, FER); birds were heard in Gn Halimun-Salak NP in 2013 (A. Owen *in litt.* 2015); in 2014, trappers reported birds from three sites in Gn Simpang Forest Reserve, east of Bandung (SvB), where birds were heard again in 2015 (A. Tritto *in litt.* 2015). However, it was not found by Mittermeier *et al.* (2014), and the high current prices of captive birds, together with the low encounter rates in the wild, point to massive reductions in many populations and the elimination of some.

White-rumped Shama *Copsychus malabaricus* (LC)

Widespread in South Asia, continental South-East Asia and the Greater Sunda Islands, the White-rumped Shama is widely recognised for its extraordinary song (Collar 2005) which has long made it a favourite cagebird in Indonesia (Shepherd *et al.* 2004, Shepherd 2006). However, an increase in the popularity of bird singing competitions in Java caused the keeping of the species to rise ‘dramatically’ between 1996–2006, with as many as 121,000 estimated to be captive in six cities on Java and Bali in 2006 (Jepson & Ladle 2009). The species is easily trapped owing to its combative response to playback (JAE, FER). Jepson & Ladle (2009) judged that it had been ‘caught out’ from Java before 1997 and demand for it then caused ‘rolling’ local extinctions across western Indonesia and ‘decimated populations in south-west and northern Sumatra... and West Kalimantan’. Despite this, birds were common in trade in Medan markets in 2012, when 4,447 were counted during weekly surveys from July to September (Giyanto *in litt.* 2014).

This excessive exploitation has significantly compromised the survival of several taxa in Indonesia, some so distinctive they might better be treated as species themselves (see Discussion). Collar (2005) recognised seven subspecies in Indonesia, but treated *mallopercnus* (West Malaysia), *javanus* (West and Central Java), *omissus* (East Java), *eumesus* (Natuna Islands) and *ochroptilus* (Anamba Islands) as synonyms of *tricolor*, and *opisthopelus* (Batu Islands) and *opisthus* (Banyak Islands) as synonyms of *melanurus*. In this review, however, we accept all these taxa except *javanus*, as well as *hypolizus* (Simeulue) and *opisthochrus* (Lasia and Babi), pending in-depth genetic and morphological analysis (FER).

Taxon *tricolor** (Sumatra, Bangka, Belitung, west and north-west Java). Until 15 years ago, this taxon was present in good numbers in several parts of Sumatra (SvB), but its persistence anywhere in walking distance of roads or towns must be in doubt. In Bukit Tigapuluh NP, eastern Sumatra, November 2015, no wild birds were observed, but one in a cage in a village enclave was said to have been caught locally (SvB). During a visit to Belitung in February 2014 four days were spent in suitable habitat and no birds were found (M. Iqbal *in litt.* 2015). In the last five years it has been recorded with certainty in Sumatra only from the wilderness of Gn Leuser NP several days’ walk from the nearest road (T. Wahyudi verbally 2015) and in Way Kambas NP, where its survival appears to be related to its comparative silence (JAE). JAE made nine visits to the latter park, 2005–2015, totalling 38 days, encountering birds four times, all silent when discovered and only singing, very quietly, in response to playback, without venturing closer. This surprising behaviour may conceivably have been selected for by years of trapping, or be learnt, or have arisen in response to artificially low densities created by trapping (reflecting loss of song in the Olomao *Myadestes lanaiensis* as it died out: Collar 2005: 561). It offers the remotest hope that small numbers of silent birds may remain elsewhere on the island. On Java it survives only (indeed perhaps the entire species: see *omissus* below) in Ujung Kulon NP, where it was still to be seen in 2012 (SvB).

Taxon *eumesus* (Natuna Islands). Not recorded in a three-day visit to the Natunas, March 2015 (FER).

Taxon *ochroptilus* (Anamba Islands). No recent surveys on these islands; status of the population unknown.

Taxon *hypolizus** (Simeulue). This endemic form, which together with races *opisthocrus* and *melanurus* constitutes a highly distinct cluster of taxa, is now seriously endangered as its forest habitat has dwindled to hilltops and steeper slopes while trapping pressure remains strong. Several recent visits to Simeulue by JAE and FER independently failed to record it in the wild. On two visits in 2014 and 2015, FER saw 10–20 birds in the only pet shop in the capital, Sinabang, where the owner explained that the rate of receipt of wild birds has recently fallen from 1–2 per week to one per month. Residents told FER there are only a few places in the highest hills, often many hours' walk from the nearest road, where there is a chance of finding a bird in the wild.

Taxon *opisthocrus** (Tapani Islands [Lasia, Babi]). This taxon, long synonymised with *melanurus* or *hypolizus*, is quite distinct morphologically and in belly colour (FER). Formerly confined to the pristine, uninhabited islands of Lasia and Babi, its continued existence in the wild is in doubt. During a visit to Simeulue's capital Sinabang in 2015, FER saw a captive bird said to have been trapped 2–3 years earlier on Lasia. On a visit also in 2015 to Babi, the radio antenna warden (the sole permanent inhabitant) confirmed to FER that this form was common as little as 5–7 years before, but was then virtually or totally extirpated by 'hundreds of Javanese trappers descending upon the island and catching thousands of shamas'. Targeted searches over 24 hours using sound recordings were unsuccessful (FER). Lasia is even smaller than Babi and according to the antenna warden was also visited by the Javanese trappers. If this taxon is extant in the wild, it must be exceedingly rare.

Taxon *opisthus* (Banyak Islands [Bangkaru, Tuangku]). Current status unknown.

Taxon *melanurus** (Nias, Siberut, Sipora, North Pagai and South Pagai). Birds from both Nias and the Mentawai group (which includes Siberut, Sipora and Pagai) are classified as the same subspecies, although they occupy two never-connected parts of the west Sumatran island chain; the two populations need checking for differences. On Nias its status is very poorly known. On Siberut and Sipora, according to local sources, numbers were greatly depleted about 5–7 years ago by trapping parties of 'hundreds of Javanese men who caught thousands of birds' because their song is said to be more complex and commands a higher price than Sumatran mainland birds (FER, JAE). A visit in 2015 to Sipora located 37 *melanurus* in 12 houses, with both sellers and trappers saying that wild birds are now 'very rare', some trappers not having encountered birds for 1–2 years (C. Naza Bocos *in litt.* 2015). A visit to Siberut's extensive western rainforests in 2014 produced a single record of a distant singing bird (JAE, FER); these forests may provide the best survival chances for *melanurus* in particular and for the complex of distinct dark-tailed forms from the west Sumatran islands in general.

Taxon *opisthopelus* (Batu Islands [Pini, Tanahmasa, Tanahbala]). Current status unknown.

Taxon *mirabilis* (Panaitan [Prinsen] Island, off westernmost Java). Current status unknown; common in the 1980s (SvB).

Taxon *omissus* including *javanus** (Java except far west and north-west as far as Indramayu, *fide* Mees [1996]). This form has always been relatively rare (de Visard de Bocarmé 1829, Vorderman 1884, Spennemann 1907), perhaps 'due to a genuine reduction of numbers caused by the capturing of many for the market as it is a beloved cage bird' (Hoogerwerf 1969). In the 1980s, it was known from only five localities in west and east Java (van Balen 1999), and although at Pangandaran, West Java, in 1990 it was considered common (Basuni *et al.* 2005), there are no recent records and it may be extinct. The species is only known to survive—barely—on Java in the race *tricolor* (see above) (SvB).

Taxon *nigricauda** (Kangean Island, off north-east Java). Forest, mostly secondary and teak, is still extensive on the island, but the

species was not recorded during five surveys in 2007–2008, and is now feared extinct (SvB).

Taxon *suavis* (Borneo except the north). Still widely distributed throughout Kalimantan (JAE), but heavily trapped for trade, e.g. two seizures in Tanjung Perak, Surabaya, East Java (November and December 2015), included 1,180 White-rumped Shama (<http://bbksdajatim.org/polhut-amankan-2-711-burung-di-tanjung-perak.php>).

Taxon *stricklandii* (north Borneo). In Malaysian territory this form appears to be relatively secure, e.g. it was still common at Poring Hot Springs, Sabah, in 2010 (Harris *et al.* 2012). However, its present status in North Kalimantan province is unclear (SvB). Seven birds were seen in two shops in Singapore, November 2015 (JAE), and although they may not have originated in Indonesia, it did confirm that this form is being traded internationally.

Taxon *barbouri** (Maratua, Celebes Sea). The recent collapse of the population of this form, from 'abundant' to 'in danger of extirpation', coincided with an influx, 2–3 years ago of Javanese construction workers who presumably took the opportunity to trap birds (Chua *et al.* 2015, Q. Phillipps *in litt.* 2015).

Asian Pied Starling *Gracupica contra* (LC)

Four of the five subspecies of Asian Pied Starling occur from South Asia to the Thai-Malay Peninsula; the disjunct fifth form, *jalla*, is endemic to Indonesia (Feare & Craig 1998, Craig & Feare 2009).

Taxon *jalla** (eastern Sumatra, Java, Bali). Feare & Craig (1998) and Craig & Feare (2009) mapped this form throughout Sumatra, but in reality it appears to be known only from Lampung province, adjacent to Java, whence it perhaps spread 'with the extension of cultivation and deforestation' (van Marle & Voous 1988). Although it was common in Lampung in 1975–1977 (van Marle & Voous 1988), there is no recent evidence of its survival on Sumatra: no records were uncovered by Harris *et al.* (2015) and no correspondent contacted for this review had seen the bird on the island (M. N. Janra, M. Iqbal and W. Novarino *in litt.* 2015). On Java and Bali, too, the taxon, 'common' according to MacKinnon & Phillipps (1993), has disappeared and apart from obvious escapes in downtown Jakarta (JAE), it has not been recorded in the wild for several years. A survey of 100 correspondents contacted via social media for information on wild populations produced records of single birds on Pulau Dua Nature Reserve, West Java, in 2005–2006 and 2013, a bird in north Jakarta a few years ago, three (undated) escapes on Serangan Island, Bali and an unspecified number trapped in the limestone hills between Gn Kidul, Wonogiri and Pacitan, Central Java, in 2010 (R. Sözer *in litt.* 2015). All the evidence points to this taxon being virtually if not totally extinct in the wild, and to trapping for the cagebird trade as the principal threat, possibly compounded by the use of pesticides (see Discussion, first paragraph). One bird was found in a Singapore bird shop, December 2015, indicating some international trade in this species, but this is possibly the only time it has knowingly been encountered in trade in Singapore (L. Neves *in litt.* 2015).

This is particularly disturbing given that the distinctiveness of *jalla* is sufficiently great to be considered for biological species status (del Hoyo & Collar *in prep.*). However, significant numbers may survive in captivity, where they are bred commercially for the cagebird market, e.g. 100 breeding pairs were being kept at Jimbung, Klaten regency, Central Java, in May 2015 (<http://anfbirdfarm.com>). This clearly offers an opportunity for a population to be established for *non*-commercial captive breeding with a view to eventual reintroduction at a time when the security of the birds can be guaranteed. However, other subspecies are believed to have been traded into Indonesia from continental Asia and, if so, they will probably have been cross-bred with *jalla* captive stock. Moreover, selective breeding for colour mutations in captivity further threatens the genetic purity of this taxon.

Black-winged Myna *Acridotheres melanopterus* (CR)

This species, which occurs in three fairly distinct subspecies, is endemic to Java and Bali (with a few records from Lombok) and was once widespread and common (Feare & Craig 1998), but has been eliminated from most of its range (for which 81 localities were mapped) principally by trade, with pesticides and habitat loss postulated as, but not proven to be, compounding problems (BirdLife International 2001). Evidence for the plight of this species, apart from its absence from the field, includes the four-fold fall in numbers recorded in bird markets since the 1990s, a startling rise in prices (US\$3 for a bird in 1987, \$15–35 in 2009, \$100–200 in 2014), and the theft by organised crime of 151 individuals from Cikananga Wildlife Center in June 2014 (Tritto & Sözer 2014, Shepherd *et al.* 2015).

Taxon *melanopterus* (Java [except where *tricolor* occurs] and Madura Island). Despite having much the largest range, the nominate is probably the most threatened. Natural populations are believed to survive at two sites near Jakarta, with possibly as few as 20 birds (some perhaps escapes) at either site (BirdLife International 2015, JAE). However, attempts have been made in recent years to re-establish populations at Rawa Danau (a protected area in far north-west Java) and Pongkor (a guarded mining concession at the boundary of Gn Halimun-Salak NP), using surplus birds from Cikananga Wildlife Center (Tritto 2014a,b) and involving the acquisition of some stock from Klaten regency (see under Asian Pied Starling).

Taxon *tricolor* (Java approximately east of Gn Bromo). Remnant populations (numbers unknown, but likely to be very low) recently survived in Baluran and Alas Purwo NPs (flock of 25, May 2009: S. P. Mahood *in litt.* 2009; flock of 35, 2011: H. Kusumanegara *in litt.* 2014), and one may also do so in Meru Betiri NP, although there is no recent information from here (SvB).

Taxon *tertius* (Bali, Nusa Penida and [presumably] Lombok). On Bali, Collar *et al.* (2012) guesstimated that 100 individuals survived in Bali Barat NP, although more recent surveys suggest 190 birds may survive there (H. Kusumanegara *in litt.* 2014), with another 12 birds recorded between 2007 and 2015 at an undisclosed site in south Bali (JAE). On Nusa Penida, birds of this species (taxon unknown) were released during an official visit by President Soeharto in 1986 (Dijkman 2007). Birds were still present in 2011 (A. Owen *in litt.* 2011), but none was found during more than two days in August 2014 (JBCH) or in two days, October 2015 (D. F. Jeggo *in litt.* 2015), despite being reported on adjacent Lembongan at Puaji Temple in 2014 (Dijkman 2014).

Bali Myna *Leucopsar rothschildi* (CR)

The repeated efforts to reverse the remorseless decline of this iconic species, only known from the west and north-west of Bali and confined for the past forty years to Bali Barat NP, have been documented in detail (van Balen *et al.* 2000, BirdLife International 2001). Domestic and international trade in the species occurred as far back as 1968, and in the mid-1970s illegal extraction from the wild was estimated to be 40–60 birds per month; supplementation of the wild population with captive-bred birds may have prevented the species from ever quite disappearing, although there was a period in 2003–2005 when birdwatching groups could never find it despite the reassurances of park staff (JAE), and independent evidence suggests that it ‘became extinct in the wild in 2006’ (Jepson 2015). Even the supplementation process fell victim to trade demand when in 1999 an armed gang with suspected military links stole 39 birds from pre-release holding cages (BirdLife International 2001). Poaching is acknowledged to persist in the park (T. Sutedi verbally 2015), and all birds now at liberty on Bali must be assumed to derive from locally sourced captive stock, given that there has been no international engagement with the conservation of the species this century, other than maintaining captive populations as a reserve (Jepson 2015).

An attempt has been made to establish a population on Nusa Penida (Dijkman 2007, 2014), an initiative portrayed as demonstrating the superiority of bottom-up community-supported conservation—which ‘embraced the affordances of the Bali starling’s phenotype (its beauty and simple ecology) to construct (or adopt) identities suitable to local cultural contexts’—over the top-down internationally driven work that preceded it (Jepson 2015). However, recent evidence suggests that other affordances (the species’s market price) have been rather more tightly embraced, since the birds have almost or entirely disappeared from the island, seemingly as a result of poaching (M. Halouate, D. F. Jeggo and A. Owen verbally or *in litt.* 2015, JBCH). Meanwhile, in October 2015 an international meeting was convened on Bali to review the status and needs of the current endeavours with the species, and re-engagement of foreign interests and stakeholders is developing—a move that further subverts the conclusions in Jepson (2015).

Hill Myna *Gracula religiosa* (LC)

With a range from south and east India to South-East Asia, the Greater Sundas and east to Alor and Sumba in the Lesser Sundas, this species has always been a heavily traded, very popular pet, beyond Indonesia’s borders, owing to its exceptional capability as a sound mimic (Bertram 1970, Nijman 2010). In recent years, its taxonomy has been unsettled; moves to separate the forms *indica*, *robusta* and *enganensis* as species (Feare & Craig 1998, Rasmussen & Anderton 2005, Craig & Feare 2009) have been resisted on the grounds that ‘DNA studies are indicated’ and ‘broader sampling... is needed’ (Dickinson & Christidis 2014). The separation of *indica* is, however, validated by the neglected evidence of Bertram (1969), mentioned by Inskipp *et al.* (1996), but apart from this, pending a new morphological analysis (Collar & Marsden *in prep.*), we here address the five Indonesian forms of *G. religiosa* as treated in Dickinson & Christidis (2014) with the addition of *miotera* from Simeulue (an island not mentioned by Feare & Craig 1998, Craig & Feare 2009 or Dickinson & Christidis 2014) and of distributional data from van Marle & Voous (1988) and Collar & Marsden (*in prep.*). Although the subspecies *venerata* occurs outside ‘Sundaic Indonesia’, it is treated here briefly for completeness.

Taxon *religiosa* (Thai-Malay Peninsula, Sumatra, Bangka, Belitung, North Natuna Islands, Java, Bali, Kangean, Bawean and Borneo). The nominate form is still common and widespread in parts of mainland South-East Asia (JAE). Good numbers can still be found in several Indonesian national parks, including Sungai Wain, Kalimantan, and Way Kambas, Sumatra, but on smaller islands and on Java the birds have been locally trapped out (JAE); the only recent observations on Java are from Ujung Kulon NP (SvB), and in the last ten years it has become extremely rare on Kangean (Irham & Marakarmah 2009).

Taxon *miotera** (Simeulue). Not seen on Simeulue during several visits between 2010 and 2015, and doubtless very rare now (if not extinct) owing to extensive trapping and a degree of habitat degradation (FER, JAE).

Taxon *robusta** (Banyak Islands [Tuanku, Bangkaru], Babi, Nias). This large form is reputedly the most accomplished mimic of all Hill Myna taxa and has therefore been very heavily exploited. Sixty-five individuals were observed during monthly surveys carried out in the Medan bird markets, with only one observed between 1997–1999 and the rest in 2000–2001 (Shepherd *et al.* 2004). These birds were sold to collectors in Indonesia (CRS). The form was not observed during a 17-day visit to Nias in May 1990, although nest-boxes for it were noted (Dymond 1994), and recent surveys have clearly established that it is almost extinct, with just a single pair (only one certainly this taxon) being found in 2015 (Anon. 2015a). A visit to Babi in 2015 established that the species has also disappeared there following the visit by Javanese trappers, 5–7 years ago, according to the radio antenna warden (see above

under White-rumped Shama); dawn vigils atop the antenna, with almost perfect views over the canopy of nearly the whole island, yielded no visual or aural evidence of Hill Mynas (FER). A small number of birds are currently known to survive in captivity, but are held in private hands with no known concerted attempt to breed them (NJC).

Taxon *batuensis* (Batu Islands [only Telo reported] and Mentawai Islands [Siberut, Sipura, North Pagai, South Pagai]). Now rare on Siberut but probably still present in secure numbers in the larger, inaccessible, western rainforests, where in 2014 one was seen in flight, and a pair was seen on a separate visit (JAE, FER).

Taxon *enganensis* (Enggano). Status unclear and extent of trapping unknown; but up to three birds were recorded on each of three visits between 2010–2014 (P. Morris and J. Olah *in litt.*).

Taxon *venerata** (Sumbawa east to Alor). ‘Populations have recently declined notably, due to trapping for the cage-bird trade’ (Coates & Bishop 1997). On Flores, young were reported to be taken from the nest for trade, producing ‘a considerable recent decline’ (Verhoeve & Holmes 1998). During 11 visits to Flores, 2005–2015, totalling 90 field days, one observation of two birds was made (JAE), although small numbers may survive in remote areas (FER). Populations on Gn Tambora, Sumbawa, and on Adonara were subject to such heavy trapping pressure that none was seen during fieldwork in 2000 (Trainor 2002a,b). On Lembata (Lomben) local informants reported that populations ‘had declined greatly in the past decade because of captures for the bird trade’ and that birds, ‘like those from Nias Island, were in great demand because they were clever (*pintar*) at mimicking sounds’ (Trainor 2003). This left Alor as a ‘regional stronghold’, with birds ‘locally common’ (Trainor 2005), but during three visits there, 2011–2014, a single bird was sighted once (JAE) and only 5+2+4 were seen in November 2015 during 11 days fieldwork covering large areas of the centre and east of the island (FER).

Straw-headed Bulbul *Pycnonotus zeylanicus* (VU)

This large bulbul, possibly the most sought-after songbird in Sundaic Asia (a range which includes southernmost Myanmar and Thailand, Peninsular Malaysia, Sumatra, Java and Borneo), has been driven by trade—possibly compounded by loss of its rather specific habitat and clearance of lowland forest along rivers (BirdLife International 2015)—from being widespread and common to the brink of global extinction. Its Vulnerable status is no longer appropriate for a species which has been pursued with a relentless intensity, possibly unmatched for any other bird species on the planet (BirdLife International 2001, Shepherd *et al.* 2013). Historical evidence indicates that it was considered common virtually everywhere in its range until at least the 1950s, but it has gone from Thailand and probably Myanmar, which has had no records since 1904 (BirdLife International 2001), and is judged to be extremely rare now in Malaysian Borneo, having disappeared from everywhere except the best-protected sites such as Kinabatangan Wildlife Sanctuary and Danum Valley (F. H. Sheldon *in litt.* 2015, JAE), although even in the latter it has recently been trapped out in places (Q. Phillipps *in litt.* 2015); the last populations in Brunei are also being trapped out (Q. Phillipps *in litt.* 2015). In Peninsular Malaysia, it has experienced a ‘near-total collapse’ (Wells 2007), and this, as elsewhere, will be due at least in part to the demand for the species from Indonesia rather than locally (Shepherd *et al.* 2013); birds found in Javan markets reportedly from ‘Lampung’, Sumatra, probably originate from Malaysia. Only Singapore, possibly colonised by escaped birds, provides any haven from the trade (Wells 2007), and there is currently no *ex situ* programme to serve as a reserve.

In Indonesia, of localities mapped by BirdLife International (2001) for the species on Sumatra (57), Java (20) and Kalimantan (42), only three, none and ten respectively (11%) referred to post-

1980 records. The species can confidently be pronounced extinct on Java, Nias and Sipora, and there are no records from Sumatra since 2010 (Harris *et al.* 2015, SvB). A 1937 record from Maratua Island (BirdLife International 2001) is evidently a misreading of a museum label for a site in Sabah (Mann 2008). It clings on in tiny numbers in remote parts of Kalimantan where ‘most bird shops’ still stock them but charge US\$300 per individual (Q. Phillipps *in litt.* 2015), and its rarity and high price are now so great that, in West Kalimantan at least, it has been replaced in markets by Grey-cheeked Bulbul *Alophoixus bres* (A. Miller verbally 2015). In Java the species has disappeared from song contests, partly because only the very wealthy can afford contemporary prices (SvB), and the continuing demand for the species is now to an unknown degree being met by an ‘Association of Straw-headed Bulbul Breeders’, which had 63 members in 2010, each with an average of 15 breeding cages, in Sumatra, Kalimantan and Java (Jepson *et al.* 2011).

Javan White-eye *Zosterops flavus* (NT)

This species of mangroves and coastal woodlands has a unique, very restricted and fragmented range along the northern coastline of Java and the southern coastline of Borneo (van Balen 2008); a record from southernmost Sarawak ‘may not be valid’ (Mann 2008).

On Kalimantan the species is very little known; it may occur in areas seldom visited by birdwatchers. On Java it was widespread along the north coast of Java and south coast of Madura between 2006 and 2009 (SvB), but on recent visits to Javan mangroves it has become increasingly difficult to locate, and only observed in very small numbers where larger flocks were previously recorded (JAE). BirdLife International (2015) does not mention trade as a threat, but during the most recent visit mentioned above trappers using decoy birds were present, and captive birds were seen in local villages (JAE). The species is a poor songster (SvB), but is presumably trapped and sold either as a companion bird or in a conscious fraud; white-eyes in general are increasingly popular (see also Iqbal 2015), with thousands sold in markets, as they are still affordable for the poorest bird-fanciers, although champion birds in song contests can fetch up to US\$5,000 (SvB). A survey of Singapore bird shops, November 2015, yielded a single individual for sale (JAE).

Rufous-fronted Laughingthrush *Garrulax rufifrons* (EN)

After the discovery that Javan Green Magpie was at great risk of extinction from Javanese trade pressure (see above), an assessment of other Javan endemic species led to the identification of this species, which shares much the same range as the magpie, as almost equally at risk (Collar *et al.* 2012, Collar & van Balen 2013, Owen *et al.* 2014, BirdLife International 2015). Despite its small range, it occurs in two fairly distinct subspecies.

Taxon *rufifrons* (West Java). Collar & van Balen (2013) identified fourteen localities for the species, but only Gn Gedepangrango had records from the previous twenty years down to the present in small numbers (JAE). Evidence from several sources clearly implicated trapping pressure, since at least the 1990s, as the cause of serious declines in the wild, resulting in a tenfold rise in prices in the first decade of the century (Collar & van Balen 2013). During surveys carried out in the Medan bird market, 1997–2008, 14 individuals were observed for sale (Shepherd 2011). An *ex situ* programme is now being developed using the last few birds to be found in markets (Owen *et al.* 2014).

Taxon *slamatensis* (Gn Slamet, Central Java). No records since 1925 (Collar & van Balen 2013) despite recent fieldwork in the area (Mittermeier *et al.* 2014), but one individual is currently held in Cikananga Wildlife Center (Owen *et al.* 2014).

Sumatran Laughingthrush *Garrulax bicolor* (VU)

Over the past ten years this little-known Sumatran endemic has been tracked in markets in Indonesia and judged to be in serious

decline, partly owing to habitat loss but principally because of the bird trade (Shepherd 2006, 2007, 2011, 2013). In Aceh, the species is still considered widespread, but very localised and heavily trapped: up to 30 were regularly observed in dealers' cages in Takengon, Aceh regency, between 2013 and 2015 (A. Nurza *in litt.* 2015). As many as 3,000 individuals (some presumably the same) were counted in weekly surveys of markets in Medan, capital of North Sumatra province, from July to September 2012 (Giyanto *in litt.* 2014), whereas by contrast from March to December 2013 156 transects (300 m each) on five mountains in North Sumatra produced a record of just one individual (JBCH). Trappers in Padang, West Sumatra, state they can still find the species in forests three days' walk from the nearest road (C. Naza Bocos *in litt.* 2015). Eight birds were found during market surveys in East Java province in 2015 (Chng & Eaton *in prep.*), and a three-day survey in Jakarta found 76 birds in 12 shops (Chng *et al.* 2015). The species is now the subject of an *ex situ* breeding programme (Owen *et al.* 2014) and a joint Czech–Indonesian initiative to attempt to generate information on its ecology (www.icsp.or.id).

Silver-eared Mesia *Leiothrix argentauris* (LC)

This species, long a popular cagebird, occurs in five subspecies from the Himalayas patchily east to southern China and south to Peninsular Malaysia, with two more subspecies on Sumatra; the assertion that one of these is the nominate (van Marle & Voous 1988) was mistaken (see Collar & Robson 2007).

Taxon *rookmakeri** (Aceh, north Sumatra). In steep decline (Harris *et al.* 2015, JAE) although still found in fairly large numbers in Jakarta bird markets: 59 individuals were observed in a three-day survey in 2014 (Chng *et al.* 2015), with others noted at Takengon, Aceh (C. Naza Bocos and A. Nurza *in litt.* 2015).

Taxon *laurinae** (montane Sumatra except Aceh). Not seen in the wild by bird tours since 2008, although prior to 2000 it was one of the most frequently encountered birds on Gn Kerinci (JAE, D. L. Yong verbally). The species was not encountered between March and December 2013 during montane transect surveys (see above under Sumatran Laughingthrush), but three were seen near Gn Sinabung, North Sumatra, on 12 August 2014 (C. Putra *in litt.* 2016). Despite the lack of field records, it was found in a Padang bird market in October 2015 and may survive in more remote areas (C. Naza Bocos *in litt.* 2015). This form was not recorded in any 2014–2015 Javan market surveys, despite the presence of many other Sumatran montane species (Chng *et al.* 2015, Chng & Eaton *in prep.*).

Java Sparrow *Lonchura oryzivora* (VU)

Ironically, as a result of the sheer volume of trade (numbers of escapes presumably being proportional to numbers traded) and its ready adoption of secondary habitats and ricefields, this estrildid finch—traded to China at least 900 years ago (Payne 2010)—has become naturalised in many parts of the world although it has all-but vanished from its native Java and Bali (BirdLife International 2001). This population collapse, a product of trade pressure compounded by persecution as a rice pest (Restall 1996), has led to nestbox schemes being initiated e.g. at the Prambanan temples complex, Central Java, where birds were seen in August 2015 (SvB), although lack of funding has recently suspended the scheme (S. Kurniandaru *in litt.*); another is on Madura, where a village was engaged in the (apparently sustainable) harvesting of large numbers of nestlings from bamboo tubes hung in trees (SvB). The only other known colonies are inside hotel and government building complexes in East Java and Bali, e.g. Melia Hotel, Yogyakarta, August 2014 (JBCH); unfortunately two have disappeared in recent years due to renovations. Birds are occasionally recorded in Bali Barat NP, although no breeding colonies have been found there to date (H. Kusumanegara *in litt.*).

DISCUSSION

Trade is the main culprit

Trade appears to have played a decisive part in the deterioration of the conservation status of all the taxa treated above. However, it is impossible in some cases to know how great the influence of other factors has been, most obviously habitat loss and pesticides. All forest and woodland species are likely to have suffered to some degree from habitat clearance; on small islands clearance will have a disproportionate effect, and for example must have contributed significantly to the near- or total extinction of the endemic subspecies of White-rumped Shama and Hill Myna on Simeulue. Meanwhile, species such as Asian Pied Starling, Black-winged Myna and Java Sparrow that make use of open and semi-open country on Java (and Bali) may have suffered from the direct and/or indirect effects of long-term pesticide use to protect crops like rice and chili; this use greatly intensified after laws were changed in 2002 (Fox 2014). Nevertheless, the available evidence continues to indicate that the main driver in the endangerment of all these taxa is trade.

This is a conservative list

We found that 13 avian species and 14 additional subspecies are at risk of extinction in Sundaic Indonesia primarily as a result of trade. However, the most salient observation to be made here is that this is a conservative list, for three reasons.

First, a number of candidates were excluded from the review largely for want of serviceable information. For example, we know that certain subspecies of the Red-breasted Parakeet *Psittacula alexandri* are now rare—nominate *alexandri* on Java and Bali (SvB), *dammermani* on Karimunjawa (Susanto 2012)—but despite the popularity of parrots as pets in Indonesia we have no evidence that trade is to blame. Moreover, besides identifying the (songbird) species of major concern, itemised above under Results, the Asian Songbird Crisis Summit in Singapore also produced a secondary list of taxa declining in response to trade, comprising: Asian Fairy Bluebird *Irena puella* (Javan race *turcosa*), Long-tailed Shrike *Lanius schach*, Chestnut-capped Thrush *Zoothera interpres*, Chestnut-backed Thrush *Z. dohertyi*, Orange-headed Thrush *Z. citrina*, Sumatran Leafbird *Chloropsis media*, Greater Green Leafbird *C. sonnerati*, Hill Blue Flycatcher *Cyornis banyumas* (Javan races *banyumas* and *ligus*), Oriental Magpie Robin *Copsychus saularis* (Javan populations), Javan Myna *Acridotheres javanicus* (native populations), Black-crested Bulbul *Pycnonotus melanicterus dispar* (Sumatra, Java and Bali), Orange-spotted Bulbul *P. bimaculatus* (race *snouckaerti*), Grey-cheeked Bulbul *Alophoixus bres* (all populations), various *Zosterops* (including Oriental White-eye *Z. palpebrosus* and Lemon-bellied White-eye *Z. chloris*), Sunda Laughingthrush *Garrulax palliatus* (Sumatran nominate *palliatus*) and Pin-tailed Parrotfinch *Erythrura prasina*.

Second, taxonomic revisions are likely to render this depressing situation worse in the near future. Asian ornithology generally has suffered from taxonomic neglect (Collar 2003), and this is certainly the case in Indonesia, where there are numerous impending revisions involving relatively cryptic taxa (Eaton *et al.* *in prep.*, del Hoyo & Collar *in prep.*) that may trigger new evaluations of the impact of trade. Thus in our primary list the Sumba race *citricristata* of Yellow-crested Cockatoo remains a strong candidate for species rank (Collar & Marsden 2014), a decoupling which would leave the remaining taxa with a far smaller global population. The White-rumped Shama complex is a major potential source of revision, with cases to be made for species rank for *Copsychus melanurus* (incorporating the forms *hypolizus*, *opisthochrus* and *mirabilis*), *C. barbouri* and *C. stricklandii* (Eaton *et al.* *in prep.*). The forms *robusta* and *venerata* in the Hill Myna complex would immediately be classified as Critically Endangered if, as appears plausible, they were to be elevated to species. One taxon from the

secondary list above, *Pycnonotus melanicterus dispar*, has already been elevated as Ruby-throated Bulbul *P. dispar* (Fishpool & Tobias 2005), while *P. bimaculatus* and *Cyornis banyumas* are currently undergoing taxonomic revision which will result in 'new' species under significant pressure from trade (Eaton & Collar 2015, Eaton *et al.* in prep.).

Third, our focus on taxa has led us to exclude threatened but taxonomically undifferentiated populations which, however, should not be forgotten as a conservation issue. The decline and extinction of many island populations in Indonesia is a significant loss of patrimonial if not genetic biodiversity, and the documentation of this phenomenon is urgently needed. Apart from some of the cases in the secondary list above, a good example is the Brahminy Kite *Haliastur indicus*, a widespread scavenger, once very common on Java but now extremely rare there (van Balen *et al.* 1993, SvB, JAE). Its disappearance has been compounded and perhaps even driven by trade, since stuffed raptors have long been popular 'souvenirs', while live birds, taken from the nest, are also very popular, despite a law proscribing their keeping (SvB); trade pressure probably intensified after the species became the 'official mascot of Jakarta' (Widyastuti 1993, Anon. 2015b).

Genetic contamination: another bird trade threat

The threat to species caused by trade does not merely involve the removal from the wild of large numbers of individuals of those species. A much less well documented but potentially grave threat comes from the escape, deliberate release or deliberate hybridisation of individuals of other species imported into areas to which they are not native (Severinghaus & Chi 2004).

Hybridisation (or simply out-competition) resulting from accidental escapes of 'exotic' taxa is a serious potential risk. On Nias, for example, Hill Mynas now kept by villagers have been imported from mainland Sumatra (T. Ouhel verbally 2015); clearly the chances of birds escaping are high, placing any remnant population of the native *robusta* in further peril. Various species of *Acridotheres myna* have been imported into Java and escaped, putting great pressure on whatever native populations remain of the endemic (but itself elsewhere exotic) Javan or White-vented Myna *A. javanicus* (SvB). Escaped Blue-crowned Hanging Parrot *Loriculus galgulus*, a species native to other Sundaic islands, have appeared occasionally on Java and may have established local populations with as yet unknown consequences for the closely related Javan endemic Yellow-throated Hanging Parrot *L. pusillus* (van Balen & Lewis 1991, SvB). Escaped White-rumped Shamas can become invasive (Fan *et al.* 2009), and the mixing of gene-pools of this variable species—or complex of species—would clearly be unwelcome.

Releases can be deliberate, for religious reasons, to gain merit and fortune, or as a well-intentioned way of disposing of confiscated birds; they may even be done by forestry authorities or city park officials to add lustre to their conservation programmes (SvB). All such releases, however, may bring disease to native populations (Gilbert *et al.* 2012, Collar *et al.* 2015), and, as with accidental escapes, there is also the danger of either out-competition or hybridisation (or both) with close relatives.

Captive stock is deliberately hybridised to enhance plumage characters to make progeny more attractive to prospective buyers (Techchoochert & Round 2013). Cross-breeding of the Javan endemic form *jalla* with other Asian Pied Starling forms, mentioned above as a risk, is probably already widespread, since there is a general liking among Indonesian bird-fanciers for individuals with more white in their plumage (R. Sözer verbally 2015).

Species depletion and substitution: a vicious cycle

A key indicator of the increasing rarity of a taxon is the price it commands in markets. In some cases the inverse relationship between the price and volume of a traded species is a dependable

signal of its wild status and much cheaper to use as a guide than field investigations into population sizes and trends (Harris *et al.* 2015). However, this method will work best when the species in question possesses some desirable characteristic in terms of colour or song but it may not work so well if there are similar taxa to substitute for them when their numbers are depleted. For example, the Javan nominate of Crested Jay is now being replaced in markets by the Sumatran and Bornean subspecies *coronatus*, and—although we do not have records to prove it—we doubt that the price of the nominate has risen in line with its rarity, simply because a similar relative can easily substitute for it.

The Asian Songbird Crisis Summit's secondary list reflects the pattern in which declines and disappearances of popular cagebird species drive shifts to other taxa, and this in turn reveals the relentless demand within Indonesian societies that drives the bird-trapping industry. When popular birds become scarce and too expensive, trappers and traders look for the next-best and more readily available species, such as Grey-checked Bulbul substituting for Straw-headed Bulbul in West Kalimantan (see above). Indeed, new species in the market may create their own fashion, in many cases presumably as buyers discover their traits and specialities. In 2015, Bar-winged Prinia *Prinia familiaris* and tailorbirds *Orthotomus* became popular, even appearing in song contests and already disappearing locally (SvB, JAE). A bird surprisingly absent from trade until recently is the Common Iora *Aegithina tiphia*, with the Java and Bali endemic race *scapularis*; it has an attractive song, and seems easy to keep judging by the large number now found in markets (SvB, JAE). However, in 2014 and 2015 it is leafbirds that have been in highest demand, with most trappers encountered in Sumatran forests exclusively looking for Greater Green Leafbird *Chloropsis sonnerati*, owing to its melodious imitative song (SvB, JAE). With these changes in supply and demand it would be relatively straightforward to devise a third-tier list of species that are already appearing in the bird markets in sufficient numbers to compensate for the secondary species that are steadily declining under the inexorable pressure of trade.

A disturbing phenomenon highlighted here is the organised trapping expeditions that ruthlessly aim to take out as many birds in a targeted population as possible. We indicate this for the Helmeted Hornbill everywhere in its Indonesian range, Yellow-crested Cockatoo on Masakambing, White-rumped Shama on Lasia, Babi, Siberut and Sipora, and Hill Myna on Babi. When set alongside other evidence—the village on Sumbawa specialising in trapping insular populations of Chestnut-capped Thrush *Zoothera interpres* (BirdLife International 2001: 2530), the 'rolling' local extinctions of Orange-headed Thrushes *Z. citrina* on Java (Jepson 2008) and of White-rumped Shamas across western Indonesia, the seemingly spontaneous eradication of the shama on Maratua by migrant workers, and the gangs that stole Bali Mynas at Bali Barat NP (BirdLife International 2001: 2383) and Black-winged Mynas at Cikananga—the industrial scale and societal scope of the exploitation of wild birds in Indonesia begin to register.

RECOMMENDATIONS

The impending and apparently actual extinctions identified in this review starkly highlight the need for a major new programme of well-coordinated activities in order to prevent further losses and create the conditions for the eventual recovery of depleted populations. Proposals relating to the Helmeted Hornbill are in Collar (2015a) and Beastall *et al.* (in press); for the remaining species we offer the following outline.

Law enforcement and improvement. Most wildlife trade in Indonesia is illegal, yet enforcement is almost non-existent (Shepherd *et al.* 2004). This cannot continue: 'The successful

conservation of biodiversity requires... the enforcement of the rule of law' (López-Bao *et al.* 2015). The illegal trade that can be found in most towns and cities throughout Sundaic Indonesia, involving in our estimation millions of birds annually, must now become the target of serious government attention, most importantly focusing on the largest urban markets but also with a tightening of regulation of smaller, often part-time markets in towns and villages, of middlemen with their individual shops and warehouses, and of closed online trading groups (Iqbal 2015). Given its social, cultural and political ramifications, such an intervention will require a national debate that considers all aspects of wildlife trafficking, a major investment of human and financial resources, an overhaul of current laws to accommodate all taxa at risk from trade, and the participation of a wide range of interested parties, international as well as national.

Public awareness campaigns. The Indonesian and in particular Javanese preoccupation with birds means that many avenues and opportunities exist to raise awareness of the effects of the bird trade on wild populations, and to campaign for changes in behaviour that lead consumers away from using markets as sources of pets and from seeking species that are threatened and protected under law. Social media, magazines and television need to be harnessed by the conservation lobby, and respected public figures recruited to provide the messages. We see this as a full-time project for at least a decade.

In situ management. Difficult and expensive as it may be, the maintenance of viable populations through site-based management must remain a key activity wherever possible. In this regard, all non-passerines in our list and many of the passerines need to be conserved *in situ* by strategically sound deployment of resources to improve the wardening of existing protected areas. Some passerine taxa—e.g. certain subspecies of White-rumped Shama and Hill Myna, plus Javan White-eye and Java Sparrow—that do not occur in protected areas must be managed through carefully designed plans of action at remote, defensible sites (possibly with the creation of protected areas as the ultimate ambition). Collaboration will be needed in tourist areas (e.g. Brahminy Kites on Thousand Islands beach resorts, White-rumped Shamans around diving resorts on Maratua Island, Java Sparrows nesting in the Prambanan temple complex). Taxa that have already disappeared will require the identification and preparation of release sites for their speedy return to the wild.

Conservation breeding. Many taxa at risk from trade have little or no short-term chance of survival owing to the continuing financial incentive they represent to trappers. One solution is to establish and maintain viable populations in captivity until conditions in the wild have improved and reintroductions can be implemented. In the past few years, the Cikananga Wildlife Center, Sukabumi, West Java, has developed into the main repository for species that are feared to be at the brink of extinction, including Javan Green Magpie, Rufous-fronted Laughingthrush, Sumatran Laughingthrush and Black-winged Myna (Collar *et al.* 2012, Owen *et al.* 2014). However, the running cost, paid by western institutions, is already high and space (despite recent refurbishment) already limited. A working agreement with Taman Safari Indonesia, Bogor, has allowed a number of birds and species to be moved there for security and as a means of distributing these taxa to zoos and parks outside the country (Singapore, Europe), both for security and to share the financial and logistical burden of growing and maintaining the stock. However, as yet there is no provision for (e.g.) the various threatened forms of White-rumped Shama, Asian Pied Starling or Hill Myna, or for Straw-headed Bulbul, Javan White-eye or Java Sparrow. Indeed, the entire suite of species outlined in this paper needs rigorous evaluation in order to put in place a coherent programme of conservation breeding within the shortest possible time-frame, but clearly more institutions, more training and more money are all crucial to any such initiative.

Commercial captive breeding. Expansion of commercial breeding of threatened species has been advocated as a 'market-based policy

instrument' to substitute for wild-caught birds (Jepson & Ladle 2009, Jepson *et al.* 2011). However, while this idea has a strong theoretical appeal, it has several practical drawbacks. First, to date it has achieved little success, apparently because demand continues to outstrip supply and wild-caught birds continue to cost less than captive-bred ones. The claim that the mobilisation of 'Java's bird breeders to supply Bali Starlings commercially' made 'the supply of wild-caught birds financially unattractive for the crime syndicate involved' (Jepson 2015) may or may not be correct, but there is no evidence that catching wild birds became financially unattractive to local poachers, or that breeding on Java had any effect on what happened with the wild or released birds in Bali. Second, genetic contamination by cross-breeding with closely related forms can and does occur when breeders seek to enhance their selling prices by hybridising with closely related taxa that confer desirable phenotypic properties (see, e.g., Asian Pied Starling above). Third, commercial breeding currently provides a convenient conduit for the laundering of wild-caught animals (Nijman & Shepherd 2015a,b) and may even encourage illegal trapping. Certainly it is only likely to work if it is both scrupulously regulated and carefully synchronised with a package of legal, financial and moral incentives and disincentives aimed at changing cultural attitudes so that already domesticated species are seen as better choices for pets than wild species.

Commercial wild breeding ('ranching'). In some places it appears that communities 'harvest' young birds sustainably from wild nests. Orange-headed Thrushes on Bali breed commonly in salak palm plantations, and their chicks are removed and hand-raised for sale, while Java Sparrows on Madura are provided with bamboo nests, and again their chicks are taken and sold into the pet trade; in both cases (although this needs checking) the exploitation is apparently not excessive and the populations are stable (SvB). Immediate surveys, analysis and long-term monitoring of villages engaged in such practices are needed to assess their durability, with a view to promoting similar initiatives for as many species—and local livelihoods—as might benefit from them. In the wild White-rumped Shamans take to nest-boxes with alacrity (Palko *et al.* 2011), and this trait could be exploited if communities could be persuaded to 'farm' the birds sustainably.

Working with trappers. In a very small number of cases, bird trappers in Indonesia have been converted into full-time guides for birdwatching tourists, resulting in a higher, more reliable income, easier, more sustainable life-style and a genuine interest in conservation (Bukit Barisan Selatan and Mt Kerinci are two examples: JAE). While such a tactic is unlikely to work everywhere, in some cases the conversion of poachers into guides and rangers, both enforcing the law and providing a livelihood, may be highly effective, as demonstrated by the Katala Foundation with the Philippine Cockatoo *Cacatua haematuropygia* (Widmann & Widmann 2008). Moreover, trappers will possess information on the species they target, as well as the networks they form part of, so they represent invaluable potential sources of support to the conservation effort.

Field, market and genetic surveys and monitoring. All taxa identified in this paper require fuller documentation relating to range, status, ecology and/or management needs. Plans are already in place for status surveys of Yellow-crested Cockatoos and species endemic to the mountain forests of West Java, and field programmes for Sumatran Laughingthrush and the Nias Hill Myna are in progress. Many of these taxa also require an in-depth phylogenetic and/or population-genetic inquiry to help clarify species boundaries. Genetic studies of various species complexes of shamans, mynas, white-eyes and other birds are urgently required to ascertain whether conservation efforts are needed to reverse the slide into extinction of various insular taxa currently at the subspecies level but possibly deserving of species status. Thus, a huge amount of dedicated field- and laboratory work remains to be undertaken.

Similarly, comprehensive and systematic surveys of bird markets to plot trends in numbers and prices of birds must continue, and the monitoring of singing contests will provide key information on the fashions and interests of the bird-buying public. Hopefully over time these activities will also be able to plot the effectiveness of all the other recommendations made here.

Activity coordination. All these suggestions form functionally independent but strategically interdependent components of an overall plan, and are only likely to be effective if they are promoted and organised through a central mechanism.

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