

## Short Communication

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### Corresponding author:

Vincent Nijman;

Email: [vnijman@brookes.ac.uk](mailto:vnijman@brookes.ac.uk)

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# Poisonous pitohuis as pets

Vincent Nijman<sup>1</sup> , Abdullah Abdullah<sup>2</sup> , Ahmad Ardiansyah<sup>3</sup>, Jessica Chavez<sup>1</sup> , Amanda Fairey<sup>1</sup>, Katherine Hedger<sup>3</sup> , Abdullah Langgeng<sup>3,4</sup>, S. Sunny Nelson<sup>1,5,6</sup>, I. Nyoman Aji Duranegara Payuse<sup>7</sup> , Chris R. Shepherd<sup>1,6</sup>  and K. Anne-Isola Nekaris<sup>1,3,8</sup> 

<sup>1</sup>TUCN/SSC Asian Songbird Trade Specialist Group and Oxford Wildlife Trade Research Group, Oxford Brookes University, Oxford, UK; <sup>2</sup>Universitas Sya Kuala, Banda Aceh, Indonesia; <sup>3</sup>Little Fireface Project, Cipaganti, Garut, Indonesia; <sup>4</sup>Kyoto University Wildlife Research Center, Kyoto, Japan; <sup>5</sup>Lincoln Park Zoo, Chicago, USA; <sup>6</sup>Monitor Conservation Research Society, Big Lake Ranch, Canada; <sup>7</sup>Universitas Warmadewa, Denpasar, Indonesia and <sup>8</sup>Anglia Ruskin University, Cambridge, UK

## Summary

Poisonous birds are rare but on New Guinea, including Indonesia's easternmost provinces, no less than nine poisonous species, eight pitohuis and one species of ifrita, are found. Pitohuis when handled can cause sneezing with numbness and burning of nasal tissue and nausea in humans. In the bird markets of western Indonesia novelty birds are traded at a premium and overexploitation of popular songbirds leads traders to find replacement species to meet demand. We conducted over 800 surveys in the bird markets of Sumatra, Java, Bali, Lombok, and Sulawesi between 1994 and 2023 and from 2015 onwards we assessed the online trade in pitohuis and Blue-capped Ifrit *Ifrita kowaldi*. We identified the species, recorded their prices and location, and the date when the birds were offered for sale. We analysed temporal trends, volumes, prices, and geographical origin of the sellers. Between 1994 and 2014 we did not encounter a single pitohui in the Indonesian bird markets. In the following years we recorded 113 pitohuis in 12 bird markets and we recorded 199 pitohuis for sale online; 248 were variable pitohuis and 54 were Hooded Pitohui *Pitohui dichrous*. No ifritas were recorded. Most pitohuis were recorded in eastern Java and Bali. Prices differed between eastern Java (mean of US\$93) and western Java and Bali (US\$185), possibly suggesting pitohuis arrive from West Papua in eastern Java and from there make their way to the outer markets. Pitohuis are marketed as “Papuan Straw-headed Bulbuls”; the Straw-headed Bulbul *Pycnonotus zeylanicus* is a very popular and expensive songbird from Southeast Asia, including western Indonesia, that has become rare both in the wild and in the markets due to overexploitation. Discussions about pitohuis on online forums rarely mention “poisonous” but when it is mentioned traders dismiss this as something not to worry about and they claim it to be dietary-dependent. Poisonous pitohuis are novelty, as well as master, birds in Indonesia, where they are marketed for their song ignoring any negative side-effects of them being poisonous. The trade in novelty species, when detected early, does allow for the authorities to intervene in a timely manner to ensure that this trade does not impede their conservation.

## Ringkasan

Burung Beracun sebagai Hewan Peliharaan. Burung beracun sangat jarang ditemukan, tetapi di Papua Nugini, termasuk provinsi-provinsi paling timur Indonesia, terdapat tidak kurang dari sembilan spesies burung beracun, delapan di antaranya adalah pitohui dan satu spesies ifrita. Pitohui dapat menyebabkan bersin, mati rasa, dan rasa terbakar pada jaringan hidung serta mual pada manusia jika disentuh. Di pasar burung di Indonesia bagian barat, burung-burung unik dijual dengan harga tinggi. Eksploitasi berlebihan terhadap burung kicau populer juga mendorong pedagang untuk mencari spesies pengganti untuk memenuhi permintaan. Kami melakukan lebih dari 800 survei di pasar burung di Sumatra, Jawa, Bali, Lombok, dan Sulawesi antara tahun 1994 dan 2023, dan sejak tahun 2015, kami meninjau perdagangan online pitohui dan Ifrita. Kami mengidentifikasi spesies, mencatat harga dan lokasi, serta tanggal ketika burung-burung tersebut ditawarkan untuk dijual. Kami menganalisis tren temporal, volume, harga, dan asal geografis para penjual. Antara tahun 1994 dan 2014, kami tidak menemukan satu pun pitohui di pasar burung Indonesia. Kami mencatat 113 pitohui di 12 pasar burung dan 199 pitohui yang dijual secara online; 248 di antaranya adalah pitohui belang dan 54 adalah pitohui topi-hitam. Tidak ada ifrita yang tercatat. Sebagian besar pitohui tercatat di Jawa Timur dan Bali. Harga berbeda antara Jawa Timur (rata-rata Rp 1,4 juta) dan Jawa Barat serta Bali (Rp 2,9 juta), yang mungkin menunjukkan bahwa pitohui tiba dari Papua Barat di Jawa Timur dan dari sana menyebar ke pasar-pasar lain. Pitohui dipasarkan sebagai ‘cucak rawa Papua’; cucak rawa adalah

burung pekica yang sangat populer dan mahal dari Asia Tenggara, termasuk Indonesia bagian barat, yang menjadi langka baik di alam liar maupun di pasar karena eksploitasi berlebihan. Diskusi tentang pitohui di forum-forum online jarang menyebutkan 'beracun', tetapi ketika disebutkan, para pedagang menganggapnya sebagai sesuatu yang tidak perlu dikhawatirkan dan mereka mengklaim hal ini bergantung pada pola makan. Pitohui beracun adalah burung unik di Indonesia, yang dipasarkan untuk suaranya tanpa memperhatikan efek samping negatif dari racunnya. Perdagangan spesies unik, jika terdeteksi lebih awal, memungkinkan pihak berwenang untuk segera melakukan intervensi guna memastikan perdagangan ini tidak menghambat upaya konservasi mereka.

## Introduction

Few people would link birds with being poisonous, but species from at least five different avian orders have been described as such, i.e. hoopoes *Upapa* spp. (Bucerotiformes), Bronzewing Pigeons *Phaps chalcoptera* (Columbiformes), Spur-winged Goose *Plectropterus gambensis* (Anseriformes), North American Ruffed Grouse *Bonasa umbellus* and European Common Quail *Coturnix coturnix* (Galliformes), and Red Warbler *Cardellina rubra*, pitohuis, and Blue-capped Ifrith *Ifritha kowaldi* (Passeriformes) (reviewed by Ligabue-Braun and Carlini 2015; Yeung et al. 2022). For some of these species the variation in toxicity in space and time, and the type of toxin and its origin are well-known, but for others many questions remain. Perhaps two of the best-known taxa are the Common Quail, a galliform, and the pitohuis, a group of songbirds. Some of the European populations of the former have been known to be poisonous since at least Roman times (Bartram and Boland 2001), whereas the latter was only properly documented in the early 1990s (Dumbacher et al. 1992).

European Common Quails are only toxic during the autumn migration when following a western flyway, from West Africa to Europe, but not following other routes. It is unknown how and where migrant quails acquire their toxicity, but when consumed by humans it can cause striated muscle tissue breakdown, renal failure, and ultimately death. Coturnism (i.e. the poisoning after consuming quail) was apparently common enough in the Mediterranean during Roman times that a ban was instigated against their consumption (Bartram and Boland 2001). Perhaps because of its rarity in recent times, coturnism remains widely understudied and, as with its potential source, information on the underlying genetic and biochemical mechanism is largely unknown (Kennedy and Grivetti 1980; Yeung et al. 2022).

The toxicology of pitohuis and related species are better studied (Dumbacher et al. 1992, 2004, 2008, 2009, 2014; Menon and

Dumbacher 2014). Pitohuis are a paraphyletic taxon (Dumbacher 2014; Jönsson et al. 2008) endemic to the island of New Guinea, with four species in the family Oriolidae (orioles), three in the Pachycephalidae, and one in the Oreoicidae (del Hoyo et al. 2016) (Table 1). Hooded Pitohui *Pitohui dichrous*, Northern Variable Pitohui *P. kirhocephalus*, Southern Variable Pitohui *P. uropygialis*, and Waigeo Pitohui *P. cerviniventris* (the latter three formerly all referred to as variable pitohuis) are poisonous, as are, to a lesser degree, the Black Pitohui *Melanorectes nigrescens* and the Crested Pitohui *Ornorectes cristatus*. A distantly related species, the Blue-capped Ifrith, likewise endemic to New Guinea, is also poisonous (Dumbacher et al. 2000; Beehler 2010).

The skin and feathers of pitohuis and ifrits contain powerful neurotoxic alkaloids of the batrachotoxin group. The handling of pitohuis can irritate nasal and buccal tissues, causing sneezing and allergic-like symptoms; in fact, it was these reactions to mist-netted pitohuis when handled that led to its scientific discovery (Dumbacher et al. 1992; Pough 1992). Dumbacher et al. (2009) noted that "batrachotoxins poison by binding to voltage-gated sodium channels in cell membranes of central nervous and muscular systems. They lock the channels open, allowing a flood of sodium ions that depolarises the cell membrane. Batrachotoxins are known to be toxic in a wide variety of animals ... and could, therefore, provide defence against a wide spectrum of potential natural enemies – from large vertebrate predators to tiny mite ectoparasites". Dumbacher et al. (2009) summarised the possible functions of these toxins and noted that they could deter ectoparasites such as lice, ticks, and hippoboscids flies as well as predators such as snakes, eagles, carnivores, and humans (see also Meon and Dumbacher 2014; Plikus and Astrowski 2014; Poulsen 1994).

Keeping songbirds is an extremely popular pastime in Indonesia, especially amongst those living on the island of Java, i.e. the Javanese, Sundanese, and Betawi (Chng et al. 2015; Fink et al. 2021;

**Table 1.** Poisonous pitohuis and ifrits, endemic to the island of New Guinea, and their status and distribution in Indonesia. LC = Least Concern

Species	Family	Distribution in Indonesia (province)	IUCN Red List status	Protected in Indonesia	Harvest quota (2016–2024)
Hooded Pitohui <i>Pitohui dichrous</i>	Oriolidae	Papua, West, Southwest, Central, Highland	LC	No	Zero
Northern Variable Pitohui <i>P. kirhocephalus</i>	Oriolidae	Papua, West, Southwest, Central, Highland	LC	No	Zero
Southern Variable Pitohui <i>P. uropygialis</i>	Oriolidae	West, Southwest, South, Central, Maluku	LC	No	Zero
Waigeo Pitohui <i>P. cerviniventris</i>	Oriolidae	Southwest	LC	No	Zero
Black Pitohui <i>Melanorectes nigrescens</i>	Pachycephalidae	Papua, West, Southwest, Central, Highland	LC	No	Zero
Crested Pitohui <i>Ornorectes cristatus</i>	Oreoicidae	Papua, West, Southwest, Central, Highland	LC	No	Zero
Blue-capped Ifrith <i>Ifritha kowaldi</i>	Ifrithidae	Central, Highland	LC	No	Zero

Okarda et al. 2022). The capture and trade of birds is a major threat to an increasingly long list of species in Indonesia pushing many species to the brink of extinction (Chng and Eaton 2016; Eaton et al. 2015; Nijman et al. 2021; Shepherd 2006; Shepherd et al. 2023) and, as popular songbirds decline, traders seek other species to meet the demand. Rare and novelty species are in demand and traded at a premium, putting pressure on bird species across the country (Bergin et al. 2018; Eaton et al. 2015; Nijman et al. 2017; Leupen et al. 2022). While the species of pitohui we recorded in trade all have been assessed as “Least Concern” on the International Union for Conservation of Nature (IUCN) Red List, for all three of the variable pitohui species their population trends (increasing, stable, decreasing) are not known. The Blue-capped Ifrit is listed as “Least Concern”. For none of these species has trade (domestic or international) been flagged up as a potential conservation concern.

We aim here: (1) to give an overview of the emerging trade in pitohuis and ifritas in the markets in Indonesia; (2) give an overview of the online trade in these species in Indonesia; (3) discuss how this trade emerged; (4) map the topology of the trade, including trade names and economic value; (5) comment on the suitability of pitohuis as pets.

## Methods

### Market surveys

We have conducted market surveys in Sumatra, Java, and Bali since 1994. The markets in Medan (in the province of North Sumatra), Jakarta (Indonesia’s capital), Bogor (West Java), Yogyakarta, Semarang (Central Java), Surabaya (East Java), and Denpasar (Bali) have all been visited at least 20 times each over this period. Over the last decade (or more specifically between 2012 and 2019 and from 2023 onwards) we have increased the intensity of these visits, focusing on the markets in Jakarta, Bandung, Garut, Tasikmalaya (West Java), Surabaya, and Denpasar. In the period 2020–2021 we made fewer visits to bird markets because of local lockdowns, restricted international travel, and to a lesser extent, temporary closure of bird markets because of Covid-19. For details on how market surveys were conducted we refer to Nijman et al. (2022) and Abdullah et al. (2024). Overall, we estimate that we have made some 800 visits to individual markets spaced at least a month apart, in the last 30 years, during which time we have recorded and identified over 800,000 wild-caught birds for sale.

Some of the surveys involved counting and identifying all non-domesticated birds in the markets (e.g. Chng et al. 2015), whereas others focused on specific conservation-dependent species as well as species that because of their novelty stood out. Pitohuis definitely fall in the latter category and would have been recorded if present.

### Online surveys

We conducted regular online searches in Google between June 2015 (when we first recorded a pitohui in a bird market) and January 2024; we focused on classified ads, Facebook posts, Instagram posts, and blogs. We only searched the open web as there was no need to search the dark web given the openness of the trade in pitohuis (wildlife traded on the dark web tends to be mostly for use as drugs; Stringham et al. 2023). Once online, ads appear to remain visible for at least several months and up to over a year. We expect that any ads posted in the first half of 2015 would have been picked up as well as many that would have been posted in 2014. As search terms we used “pitohui”, “cucak rawa papua”, “cucak papua” (local names for

pitohuis) in combination with “dijual” (for sale) or “harga” (price). When this led to an entry on an online platform, we searched within this platform to locate additional entries. When comments were posted these were read and relevant information extracted. For each post we identified species, numbers for sale, date of the posting, location of the seller, number of views, and price.

## Analysis

We assumed that the birds we observed in the physical bird markets were different individuals from the ones that were offered online; in a small number of cases these physical shops do have an online presence as well but mostly they sell to customers visiting their shops in person. Furthermore, we assumed that birds do not move between markets.

Identification to the species level was made in the markets based on physical appearance and photographs or video clips of the birds that were offered for sale. Most variable pitohuis that were observed clearly enough were identified as Northern Variable Pitohuis as opposed to Southern or Waigeo Variable Pitohuis. Black-headed (Northern and Southern) Variable Pitohuis are very similar in appearance to Hooded Pitohuis, and we expect that a small number of Hooded Pitohuis we observed in the online trade may in fact be Northern Variable Pitohuis (the voice of Hooded Pitohui is usually lower than that of the variable pitohuis but this is something that is rarely recordable during market surveys). Asking prices were collected in Indonesian rupiah. These were corrected for inflation (so that for instance Rp 10,000 in 2016 is the equivalent of Rp 11,975 in 2023) and converted to US dollars using a conversion rate of Rp 13,600 per 1 US\$.

## Results

### Trade in bird markets

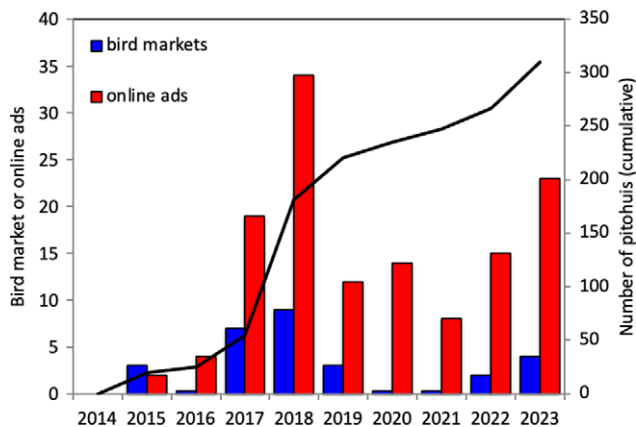
Blue-capped Ifrit was not recorded during any of the surveys. No pitohuis were recorded during any of the visits over the period 1994–2014. In June 2015, 18 variable pitohuis were observed in the three bird markets in Surabaya, East Java. None were observed in 2016. In 2017, one variable pitohui was recorded in Sukahaji market in Bandung, West Java (February) and one in Pon market in Semarang, Central Java (March), one in Pramuka market in Jakarta (May), and two in Satria market, Denpasar, Bali (March). In October, one Hooded Pitohui was observed in Denpasar and one at a bird seller in Makassar, Sulawesi (November). From 2018 onwards trade became more extensive: in all, 111 variable pitohuis were observed in 12 bird markets, and two Hooded Pitohuis were observed, one in Denpasar and one in Bandung (Figure 1). No pitohuis were recorded in Sumatra.

### Online trade

The first online ad we found for a variable pitohui was posted on June 2015, but we were not able to establish where the seller was based (Figure 2). Two ads were posted in 2015, four in 2016, 19 in 2017, and 34 in 2018, and from then onwards the number of ads increased considerably. In all we found 199 pitohuis for sale online, 137 variable pitohuis, 52 Hooded Pitohuis, and 10 which we were not able to identify to the species level. One seller based in Jakarta stated that he had been breeding pitohuis since 2008 but we found no supporting evidence to back up his or her claim. One breeder in Surakarta offered three Hooded and six Northern Variable Pitohuis for sale on a specialised Facebook page (Pitohui



**Figure 1.** From top left, clockwise: Hooded Pitohui *Pitohui dichrous*, offered for sale by a seller in Jakarta (December 2023; asking price US\$72); variable pitohui, offered for sale by seller in Bekasi, West Java (October 2023); Northern Variable Pitohui *Pitohui kirhocephalus* for sale at Satria bird market in Denpasar, Bali (January 2020), Northern Variable Pitohui (lacking tail) offered for sale online for US\$66 (first posted February 2018), with the seller based in Sidoarjo, near Surabaya in East Java; Northern Variable Pitohui, Jakarta (first posted March 2017), with an asking price of US\$346. (Photographs: Vincent Nijman, Jessica Chavez, S. Sunny Nelson, and Ahmad Ardiansyah)



**Figure 2.** Changes in the trade in pitohuis in western Indonesia over time. The continuous line represents a minimum estimate of the cumulative number of birds that were offered for sale online and in bird markets.

Indonesia) in June 2018 and October 2018, at the same site, a Surabaya-based wholesaler offered 40 Hooded Pitohuis for sale to other traders. From then onwards more traders offered the species online, but it became more challenging to verify if they indeed had the number of birds available as stated.

### Sellers and monetary value

Geographically, most of the traders were based on the island of Java, with an additional three on Bali, one on Lombok, and one on Sulawesi (Table 2). Within Java at least 14 traders were from the Greater Jakarta area, 10 from Greater Surabaya, and 3 from

Semarang. At least four traders were based in Denpasar (Bali). We found no evidence of pitohuis being offered for sale in Sumatra or Papua.

We obtained 23 quotes for pitohuis, all but one for variable pitohuis. The lowest asking price was US\$66 and the highest US\$346. Overall, there was a weak positive relationship between mean asking price in a city and its 2023 government recommended minimum wage, and the asking price for a pitohui equated to roughly three weeks of minimum wage, making it affordable for most middle-class customers.

Prices in western Java, including Greater Jakarta, are US\$182 and range from US\$110 to US\$346. This is similar to the asking price in Bali (mean US\$196, range US\$184–220). Prices in eastern Java, including the Greater Surabaya are significantly lower, with a mean of US\$93 (range US\$66–158). Surabaya is the main port (both by air and over sea) in western Indonesia for trade out of eastern Indonesia, including Papua, and the lower prices here are indeed suggestive that the pitohuis enter Java from Papua via Surabaya.

### Trade names

Papua is a linguistic hotspot with a very large number of languages spoken on the island. Undoubtedly there are many local, Papuan, names for the different species of pitohuis, including Oramo (Kamoro), Kiwula (Dani), and Pitohou (Manokwari) or Pitohui. Four main languages are spoken on Java, i.e. Betawi in the Greater Jakarta area, Sundanese in western Java, Javanese in eastern Java, and Bahasa Indonesia is a lingua franca spoken throughout Indonesia.

The names given to pitohuis in bird field guides that have been translated into Bahasa Indonesia are Pitohui Belang for the variable

**Table 2.** Trade in pitohuis in Java and Bali, with the numbers of birds observed in bird markets and on online platforms during 2015–2023. All prices (mean  $\pm$  SD) were collected in Indonesian rupiah and converted to US dollars using a conversion rate of Rp 13,600 per 1 US\$

Region	Town	Bird market	Online	Mean price (independent quotes)
Western Java	Greater Jakarta	3	42	US\$182 $\pm$ 70 (10)
	Bogor	0	4	
	Bandung	17	7	
	Tasikmalaya	0	1	
Eastern Java	Semarang	12	3	US\$93 $\pm$ 29 (10)
	Greater Yogyakarta	0	13	
	Surakarta	15	15	
	Greater Surabaya	41	58	
	Madiun	0	4	
	Malang	1	2	
	Pasuruan	0	1	
	Kebumen	0	1	
	Blitar	0	1	
	Bali	Denpasar	18	1
Lombok	Mataram	5	2	
Borneo	Banjarmasin	0	1	
Sulawesi	Makassar	1	0	
Unknown		0	43	

pitohui and Pitohui Kepala-hitam for the Hooded Pitohui. These are more or less literal translations of their English common names and they appear not to be used in the trade. Hooded and variable pitohuis are orioles; the Indonesian name for an oriole is Kepudang but this is not used to indicate pitohuis in the trade either. The names used in the trade are Cucak Rawa Papua or Cucak Rawa Rotan (or using Javanese spelling, Cucak Rowo), Cucak Papua, Cucak Emas or, rarely, Cucak Variabel. Cucak is the generic name for a bulbul (Pycnonotidae) and Cucak Rawa is the name of one of the most desirable and valuable songbirds, the Straw-headed Bulbul *Pycnonotus zeylanicus*. Pitohuis have very loud and melodious songs and, by drawing parallels to Straw-headed Bubluls, they are marketed in the Javan markets by highlighting these qualities. Indeed, some online traders in their advertisements compared the song of the variable pitohui with that of the Straw-headed Bulbul.

### Poisonous birds as pets

While some of the traders we spoke to in the markets indicated that the birds were indeed poisonous, none indicated that this would be a problem for keeping them as pets or that handling pitohuis could cause discomfort. One trader in Bandung, referring to a Hooded Pitohui stated that “it is poisonous and it can kill you in minutes”. Another trader in Bali, who regularly offered pitohuis for sale, was of the opinion that only the Hooded Pitohui was poisonous whereas the Northern Variable Pitohui, this being the species he offered for sale the most often, was not. While in general bird traders in the

markets have excellent knowledge of the birds they have on offer, it seems that in trade pitohuis are mostly grouped by their general appearance and some of the Black-headed Variable Pitohuis, being very similar in appearance to Hooded Pitohuis, were grouped with Hooded Pitohuis.

In the online forums – often linked to the posts advertising pitohuis for sale – there are some discussions related to their poison. One seller answered that pitohuis obtain their poison from their food and that when you feed them “voer” (the standard bird feed sold commercially throughout Indonesia) it makes them “normal”. On the specialised Facebook page some posters received questions on whether or not the birds were indeed poisonous, but overall, this did not emerge as a major theme in the threads. While it is evident that pitohuis are seen as novelty birds they are also used as “Master birds”, whereby other species that are popular in songbird competitions (such as Straw-headed Bubluls, White-rumped Shama *Copsychus malabaricus*, and Oriental Magpie-robin *Copsychus saularis*) can learn to mimic parts of the pitohui’s song, thus increasing their vocal repertoire.

### Discussion

We report for the first time the large-scale trade in songbirds that have only entered the songbird trade market in recent years. While a few hundred birds being traded over a nine-year period may not appear much, it should be acknowledged that our surveys, extensive though they were, could only capture a fraction of the market. We have no data on how pitohuis are taken from the wild and how they enter the trade. Dumbacher (1999) writes that “Merely handling these birds – removing them from nets and preparing specimens – caused us to sneeze, experience watery eyes and runny noses, and generally respond as if we were having allergic reactions. Similar experiences with pitohuis have been reported by other ornithologists ... and by anthropologists ...”. The question on how the handling of pitohuis in trade affects humans remains unclear but it is clear that the level of poison varies dramatically between individuals, populations, and species, with the most poisonous having an effect on a human just by handling alone. It is therefore possible that traders have selectively targeted the least poisonous populations and these are the ones we observe in trade in western Indonesia. Traders were correct in their assertion that Hooded Pitohuis are indeed more poisonous than variable pitohuis, but incorrect in stating that the latter is not poisonous (e.g. Dumbacher et al. 2009; Ligabue-Braun and Carlini 2015).

Illustration of the changing views of pitohuis and ifritas in the Indonesian pet trade comes from three articles on Om Kicau, a popular website for Indonesian bird keepers and hobbyists. In July 2013, thus before we had observed any pitohuis in trade, it gave a very detailed overview of the various species of pitohui and Blue-capped Ifrit, including descriptions of their general appearance and examples of their calls could be heard and downloaded (Munandi 2013). It noted that “... because its skin and feathers contain poison, people rarely, if ever, dare to catch it. Even if it was sold, who would want to buy a poisonous bird? He.. he.. he..” and it ended with “As kicaumaniacs (songbird lovers; kicau means chirping in Bahasa Indonesia), we should play a role in maintaining the sustainability and balance of nature so that these unique birds are protected from extinction and illegal trade”. In June 2016, it was noted that while poisonous this does not reduce interest in keeping pitohuis, and a warning was given about avoiding direct contact (Munandi 2016). In March 2018, the same author again, painted a very different

picture, reflective of how the views of pitohuis as pets had changed (Munandi 2018): “[Pitohuis] are not commonly found on the market, and they can only be found in certain bird shops or through online buying and selling forums. These birds are increasingly in demand, because its chirping sound can be used as a master for other birds”.

There are no pitohuis in international zoos, and few in Indonesian zoos (one or more Hooded Pitohuis in Taman Mini Indonesia Indah Zoo in Jakarta, and one or more Northern Variable Pitohuis in Batu Secret Zoo in Batu, East Java), but this may soon change. The large number of individuals, of at least two species, that are present in private captive hands in Java are a valuable resource for studying the mechanisms of how and why pitohuis are poisonous. Thus far, all the research relied on a relatively small number of wild-caught individuals from Papua. The captive population allows for detailed study and analysis of the effect of age, sex, and external factors such as diet on the development and persistence of toxicity. Questions on whether newly hatched chicks already have a baseline level of toxicity in the feathers and other tissues can be more easily studied in captivity, as is the development of toxicity over time. Manipulation of diet, other than perhaps supplementation, is nearly impossible in wild populations of pitohuis, but is easily achieved in captive settings.

Trade in wild-caught birds is strictly controlled in Indonesia. Over 400 of the 1,700+ bird species that occur in Indonesia are protected and cannot be traded at all. The remaining species can be traded commercially, but these are subject to a quota whereby every year only a restricted number of birds from selected provinces can be traded. While pitohuis and the Blue-capped Ifrid are not included among Indonesia’s protected species, a quota has never been allocated to any of the species of pitohuis or the Blue-capped Ifrid. Subsequently, these species are not allowed to be traded, and therefore all the trade we observed both in the markets and online is illegal. However, enforcement of the regulations concerning the trade in wild birds is wholly deficient and in practice all but the most high-profile birds can be (and are) traded with impunity (Bergin et al. 2018; Nijman et al. 2021; Shepherd 2006).

As noted elsewhere (Nijman et al. 2021), a first step in trying to curb the illegal aspect of the wildlife trade, and to better regulate the legal trade, is to obtain an accurate picture of which species are traded, and in what numbers, where the trade occurs, and how trade networks operate. This should be seen not as a one-off process but, given the dynamic aspects of at least some parts of the wildlife trade, something that should be done continuously or at least regularly. Much of what earlier bird market surveyors wrote in the 1990s and 2000s (e.g. Nash 1993; Shepherd et al. 2004) with regard to the trade in wild-caught birds still rings true to this day. However, important aspects, including what species can be traded, species composition, and regulation, have changed (Fiennes et al. 2024). This includes the sale of novelty species, such as pitohuis as reported here, and this underscores the value of contemporary, high-quality data on all wildlife trade in setting the conservation agenda.

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KAIN wrote the initial manuscript; VN, JC, SSN, and AhAr provided photographs; AbAb, AhAr, JC, AF, KH, AL, SSN, INAP, and CRS reviewed and edited the initial manuscript and contributed to the revisions. All authors contributed to the final manuscript and read and approved it.

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