

Emerging evidence of international trafficking of the Critically Endangered Maleo *Macrocephalon maleo*: a newly recognised threat to the species' survival

CHRIS R. SHEPHERD^{1*}, UTTARA MENDIRATTA^{2,3}, PAWAN SHARMA⁴, LORETTA SHEPHERD⁵, ANNA FOURAGE⁶ & VINCENT NIJMAN^{6,7}

¹Center for Biological Diversity, P.O. Box 200, Big Lake Ranch, B.C., V0L 1G0, Canada.

²Department of Criminal Law and Criminology, Vrije Universiteit Amsterdam, De Boelelaan 1077 (Initium building), 1081 HV Amsterdam, The Netherlands.

³Wildlife Trust of India, F-13, Sector 8, National Capital Region (NCR), Noida 201301, India.

⁴Resqink Association for Wildlife Welfare (RAWW), 203 Shivgiri CJS Ltd, Near Fire Brigade, Mulund West, Mumbai 400080, India.

⁵Monitor Conservation Research Society, P.O. Box 200, Big Lake Ranch, B.C., V0L 1G0, Canada.

⁶Oxford Wildlife Trade Research Group, School of Law and Social Sciences, Oxford Brookes University, Oxford OX3 0BP, UK.

⁷EcoVerde Global Consulting, Sacramento, USA and Oxford, UK.

*Corresponding author. Email: cshepherd@biologicaldiversity.org

The Maleo *Macrocephalon maleo* is a Critically Endangered, monotypic bird species found only on the islands of Sulawesi and Buton in Indonesia. Known for its distinctive reproductive ecology, the species nests communally at traditional breeding sites, with peak egg-laying periods varying across regions. While habitat loss and egg collection have long been recognised threats, international trade has not previously been documented as a risk to the species. The species is legally protected in Indonesia and, with few exceptions, neither the birds nor its eggs can be traded. Here, we review all international trade in the species from 1975 to 2024 and successful prosecutions of people illegally trading in Maleos in Indonesia from 2010 to 2025. Legal trade over those years was minimal. No-one seems to have been prosecuted for trading Maleos or their eggs. We found evidence of Maleos being trafficked internationally, with three multi-species wildlife seizures made in 2024. On 24 June, five juvenile Maleos were intercepted at Mumbai airport, India. On 29 July, 12 Maleos were seized in Jakarta, Indonesia, en route to India. On 1 December, eight Maleo were seized at Cochin airport, India. Many of these birds were recently hatched, suggesting that they were collected directly from nesting grounds (there are no records of successful commercial breeding of this species). While the Maleos seized at Mumbai died before the repatriation process could be completed, the birds seized at Cochin were repatriated to Thailand as the port of origin, where they have been housed in a government rescue centre. The fact that none of the birds reached Indonesia raises serious concerns regarding challenges faced in handling, legal procedures and long-term conservation outcomes. These incidents expose a previously undocumented threat to the species and highlight a critical gap in international enforcement and repatriation protocols. We urge authorities in Indonesia, Thailand and India to enhance border controls, increase airport surveillance, and establish a clear protocol for returning seized Maleo to Indonesia for possible reintroduction to the wild. Furthermore, we recommend that international trade be formally recognised as a threat in the IUCN Red List assessment of this species. Coordinated regional enforcement and urgent conservation action are essential to prevent further illegal trade and to ensure the species' survival.

INTRODUCTION

The international wildlife trade poses a significant threat to the survival of an ever-growing number of species, with much of the trade being both illegal and unsustainable. One of the most alarming aspects is the trade in live animals for pets and private collections, which involves a wide variety of species and frequently targets those that are rare or already highly threatened (Hughes *et al.* 2023). Indonesia plays a central role in this crisis, acting as both a major source and consumer of illegally traded wildlife, a dynamic particularly evident in the country's extensive bird trade (Chng *et al.* 2015, Harris *et al.* 2015, Nijman *et al.* 2022).

Birdkeeping is culturally widespread in Indonesia, particularly for songbirds, which are highly valued for competitions and are heavily exploited within the pet trade (Marshall *et al.* 2021). Although the scale of the trade is difficult to quantify, estimates suggest that millions of songbirds (Passeriformes) are traded annually (Nijman *et al.* 2017). Other species, including parrots (Psittaciformes), are also heavily traded (Pires *et al.* 2021, Smith *et al.* 2025). Market surveys show that a considerable number of traded birds are endemic species, a number of which are threatened according to the IUCN Red List of Threatened Species (Chng *et al.* 2015, Olah *et al.* 2016). This sustained exploitation is

contributing to population declines and increasing extinction risk for numerous species, thereby undermining broader conservation efforts.

The Maleo *Macrocephalon maleo*, in the order Galliformes, is endemic to the islands of Sulawesi and Buton in Indonesia and is currently classified as Critically Endangered on the IUCN Red List (BirdLife International 2021). This distinctive bird is monotypic, with no recognised subspecies (Elliott & Kirwan 2020). Maleos exhibit year-round breeding, with regional variation in peak laying periods. In North Sulawesi, egg-laying peaks between October and April, while in South-east Sulawesi, activity is concentrated between May–July and November–January (Elliott & Kirwan 2020). Fresh burrows have also been recorded in September in the south-east (Wardill *et al.* 1998). The species is thought to be monogamous, forming long-term pair bonds that are likely to last for life (Jones *et al.* 1995). Maleos nest communally at traditional nesting grounds, which are burrows typically located on sun-heated sandy beaches, lake shores or geothermally active riverbanks (MacKinnon 1981, Argeloo 1994, Gorog *et al.* 2005). Mating occurs away from these sites and breeding pairs usually arrive at nesting grounds in the evening, lay eggs the following morning and depart shortly after, although females occasionally lay in the afternoon (Argeloo 1994, Jones *et al.* 1995). The eggs are buried 10–100 cm below the surface in soil with temperatures of

32–39°C (Jones *et al.* 1995). Incubation takes 62–85 days (Jones *et al.* 1995).

Demand for Maleo mainly comes from egg collection for local consumption and is a major threat to the survival of the species (Elliott & Kirwan 2020). This pattern of exploitation is seen among other megapode species in Indonesia, such as the Moluccan Megapode *Eulipoa wallacei*, which has similar reproductive strategies, including communal nesting and the production of large, nutrient-rich eggs that are heavily harvested by local communities (Leimena *et al.* 2022). While collecting eggs and hunting adult birds for sport and food are listed as threats to Maleo on the IUCN Red List (BirdLife International 2021), the assessment does not document international trade in live birds. Here, we highlight trafficking and seizures of Maleo in India, Indonesia and Thailand, providing evidence that illegal international trade should be considered a threat to this species. We furthermore document evidence of a lack of enforcement and of successful prosecution of offenders involved in the illegal trade and trafficking of Maleos (live birds and eggs) in Indonesia.

MATERIALS AND METHODS

Legal international trade in Maleos

Maleos have been listed under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) Appendix I since CITES entered into force in 1975. We consulted the CITES trade database in April 2026 for records of international legal trade in Maleos, covering the period 1975 to 2024, to understand the quantities, sources and purposes of that trade. CITES trade data are used to monitor patterns and volumes of international wildlife trade, enabling the identification of trends, inconsistencies and potential illegal activity. These data also inform conservation assessments and policy decisions, including evaluations of trade sustainability.

Trafficking of Maleos

We searched the internet for reports linking Maleos to trade, with separate searches for Indonesia and other regions. The search was conducted in June 2025 and April 2026, primarily using Google, Google Scholar and the Web of Science. For Indonesia, the initial search was in Indonesian [key words: *burung maleo* (maleo bird), *sita* (root of seizure), *perdagangan* (trade) and *bksda* or *gakkum* (abbreviations for the Indonesian authority responsible for confiscating protected wildlife)]. In addition, we searched for English reports of trade in Maleos. We used Google Scholar and the Web of Science for articles and reports from the scientific literature; this included work published in all major European languages as well as Indonesian. We consulted the Wildlife Trade Portal (www.wildlifetradeportal.org), TRAFFIC’s open-source wildlife seizure and incident database. This database allows users to search for seizure incidents by species, country of the incident, commodity type, quantity and date. We searched by species

(Maleo) and the entire period. However, we did not find any reports of seizures that we had not found in our earlier search.

Prosecution of traffickers of Maleos

In October 2025 and again in April 2026, we consulted the Directory of Decisions of the Supreme Court of the Republic of Indonesia, and searched for all court cases mentioning Maleo, *burung maleo* or *Macrocephalon maleo*. This covered the period 2010 to 2025. We read the ruling and extracted information on the date and location of the court case; the reason for sentencing (killing, keeping, transporting and/or trading), the sentence (length of prison sentence, fine, and length of prison sentence when the fine was not to be paid), the number of Maleos that were involved in the case (dead or alive, eggs), and if any other protected wildlife was involved in the case.

RESULTS

Legal and illegal international trade in Maleos

There is very little legal international trade in Maleos. The CITES trade database lists a small number of transactions of international trade in specimens for scientific or educational purposes, primarily originating from captive-bred or captive-born birds from the USA. There were only two occasions on which birds were traded internationally. Both incidents were between zoos (two birds from Japan to the USA in 1992 and four birds from the USA to Denmark in 2018). Importantly, Indonesia, over this 50-year period, never reported a single export of Maleos (birds, eggs or parts) to the CITES Secretariat.

In 2024, three multi-species seizures were made that included Maleos (Table 1). The first seizure was made on 18 June at the international airport in Mumbai, India, from an IndiGo Airlines flight arriving from Jakarta, Indonesia, and included five Maleo as well as 10 other birds, including Magnificent Riflebird *Ptiloris magnificus*, Pale-billed Sicklebill *Drepanornis bruijnii* and one Proboscis Monkey *Nasalis larvatus*, as well as one unidentified bird species. The Maleo birds seized in Mumbai were all in juvenile plumage and had obviously been captured shortly after leaving their burrow-nests (Figure 1). The Maleos were handed over to a rescue centre to hold until repatriation. The birds could not be immediately repatriated due to delays in permission by the airlines and, unfortunately, they all died over the subsequent weeks.

The second seizure occurred on 29 July 2024 in Jakarta, *en route* to Mumbai, India, and included 12 Maleo. Other species in this seizure included two Twelve-wired Bird-of-paradise *Seleucidis melanoleucus*, six Magnificent Bird-of-paradise *Cicinnurus magnificus*, seven Black Sunbird *Leptocoma aspasia* and two Brown-throated Sunbird *Anthreptes malacensis*. The animals were packed in four suitcases and were to be loaded onto an IndiGo Airlines flight. Four Indian men were arrested, all between the ages of 46 and 48 years, and the alleged payment was a holiday in Indonesia and payment of INR10,000 (~USD107).

Table 1. Summary of three Maleo seizures in 2024 in Indonesia and India.

Seizure date	Seizure location	Origin	No. of Maleo	Other species	Status of seized Maleo
18 June 2024	Mumbai Intl Airport	Jakarta	5 (live)	Magnificent Riflebird <i>Ptiloris magnificus</i> , Pale-billed Sicklebill <i>Drepanornis bruijnii</i>	Dead
29 July 2024	Jakarta Intl Airport	–	12 (live)	Twelve-wired Bird-of-paradise <i>Seleucidis melanoleucus</i> , Magnificent Bird-of-paradise <i>Cicinnurus magnificus</i> , Black Sunbird <i>Leptocoma aspasia</i> , Brown-throated Sunbird <i>Anthreptes malacensis</i>	Unknown
1 December 2024	Cochin Intl Airport, Kochi	Bangkok	8 (live)	Magnificent Bird-of-paradise, King Bird-of-paradise <i>Cicinnurus regius</i> , Visayan Hornbill <i>Penelopides panini</i>	4 confirmed alive and 4 unknown



Figure 1. Maleos *Macrocephalon maleo* seized in Mumbai, India, in June 2024 were all in juvenile plumage.

A third seizure took place at Cochin International Airport, Kochi, India, that had arrived on a Thai Airlines flight from Bangkok, Thailand, on 1 December 2024. Eight Maleo were seized along with two Magnificent Bird-of-paradise, two King Bird-of-paradise *Cicinnurus regius* and two Visayan Hornbills *Penelopides panini*. The birds were transported in plastic boxes in the passengers' baggage. Two Indian nationals, a woman and a man, from Kerala were apprehended. As per reports, they were offered INR75,000 (USD754) to smuggle the animals.

These birds were returned to Thailand, which was where the illegal consignment had originated. On 22 September 2025, two co-authors observed four adult Maleo birds in a government wildlife rescue and breeding centre run by the Department of National Parks, Wildlife and Plant Conservation (DNP) in Thailand. Staff at this facility reported that the other four Maleo were kept in another DNP facility nearby. It is currently unclear whether Thai authorities intend to repatriate the birds to Indonesia. However, on 30 March 2026, one co-author observed the four adult Maleo birds in the same exhibit at the same facility (Figure 2). There was new animal-identification signage at the exhibit that had not been present on the previous visit in September 2025, implying that the birds will not be repatriated soon.

Prosecution of traders involved in Maleo

While numerous court cases were flagged in our search, these all turned out to be unrelated to the trade in Maleo birds or eggs but instead referred to, for instance, surnames ('bin Maleo') or

road names ('Jalan Burung Maleo'). We found no evidence of any person being successfully prosecuted for trading, trafficking or keeping Maleos.

DISCUSSION

While there appears to have been limited legal international trade in Maleos over the last 50 years, it is concerning that in 2024 we observed three cases involving 25 live individuals being smuggled out of Indonesia to India either directly or via Thailand. This figure may represent only a fraction of the actual number of Maleos traded, as the wildlife trafficking data are largely derived from seizure records, which reflect only detected and reported cases (UNODC 2020). The other species in the shipments that were seized included mainly other Indonesian species (or species that could have been sourced from Indonesia) as well as some from neighbouring countries. Thus far, with respect to trade in Maleos, the focus has been on the large-scale, domestic trade in their eggs as an impediment to their conservation (Argeloo 1994, Froese & Mustari 2019, Summers *et al.* 2023, 2025), rather than the trade in the birds (adults or chicks) themselves. A small number of Maleos, presumably victims of domestic trade, have ended up in animal rescue centres in Sulawesi (Anonymous 2017), but this has not resulted in any prosecutions.

In Indonesia, Maleo have been fully protected since 1970, when they were added to the Dierenbeschermings Ordonantie of 1931 (SK Menteri Pertanian No 421/Kts/Um/8/1970). Currently, they are fully protected by law under the *Act of the Republic of Indonesia No. 5 of 1990 Concerning Conservation of Living Resources and their Ecosystems* and *Government Regulation No. 20 of 2018* that generally prohibits commercial use of protected species, including catching, hunting, injuring, killing, keeping, possessing, transporting or trading, whether alive or dead.

In India, the *Wild Life (Protection) Act, 1972* regulates the trade, possession, breeding and transfer of species listed under the CITES Appendices, requiring government authorisation for any dealings involving Appendix I species. A 2022 Amendment Act, which came into effect on 1 April 2023, incorporated a legal framework to cover non-native CITES-listed species for the first time, thereby strengthening regulatory control and imposing penalties related to their trade and possession.

In Thailand and Indonesia, CITES Appendix I, II and III species are subject only to relevant controls at national borders (OECD 2019). Under the Thailand *Wild Animal Reservation and Protection Act (WARPA), as amended in B.E. 2562 (2019)*, non-native species listed under CITES are not automatically protected domestically unless they are specifically included on a list of controlled species designated by the Department of National Parks, Wildlife and Plant Conservation (DNP). Species on this list currently include only 67 non-native species, including 29 bird species that do not include Maleo. As a result, threatened species, regardless of their legal status in their country of origin, that are not included on the list can legally be sold within Thailand, clearly creating a loophole that incentivises smugglers to move trafficked wildlife across Thailand's borders and into its domestic economy (OECD 2019). Since Maleo are listed in Appendix I of CITES, India, Indonesia and Thailand are all Parties to CITES and are therefore obligated to prevent illegal international trade in Maleo.

As eight of the birds seized in India arrived having passed undetected through Thailand, it is important therefore to encourage the authorities in Thailand to increase vigilance for the trafficking of wildlife from Indonesia to India, especially when it concerns Critically Endangered species nearing extinction. Five of the birds arrived from Jakarta, and as such, authorities in Indonesia also need to maintain vigilance. Because the species



Figure 2. Four Maleo housed in a government facility that were seized in Kochi, India, and returned to Thailand in December 2024.

may be less familiar to enforcement authorities outside Indonesia, particularly in major transit countries and key transport hubs, there is a need to increase awareness and improve detection capabilities along trafficking routes.

CONCLUSION

Given Maleo's unique and specialised breeding ecology, it is highly improbable that this species could ever be bred in captivity on a commercial scale. Nonetheless, the Government of Indonesia has reportedly issued at least one permit to a bird breeder, although no successful breeding outcomes have been documented from this facility (Resit Sozer, pers. comm. to Chris R. Shepherd, 17 September 2025). In the absence of verifiable captive-breeding success and required documentation, it should be assumed that all Maleo individuals found in international trade have been taken illegally from the wild.

Indonesia remains a global hotspot for the illegal export of birds into the international wildlife trade (Chng *et al.* 2015, Eaton *et al.* 2015). To combat this ongoing crisis, we urge Indonesian authorities to significantly strengthen enforcement and surveillance at all international airports, placing particular emphasis on high-risk species such as the Maleo. Likewise,

Thailand's international airports continue to serve as key transit hubs for illicit wildlife shipments (Stoner & Shepherd 2020, Jiao *et al.* 2021). Thai authorities must intensify their monitoring efforts, improve detection protocols and enhance collaboration with international enforcement networks to curb the flow of trafficked wildlife. Authorities in India, as an increasingly significant centre of demand for live wildlife, are also strongly encouraged to remain vigilant regarding the trafficking of protected species from Indonesia, including the Critically Endangered Maleo, and to investigate the domestic demand for exotic and endangered species that fuels such trade.

An urgent and clearly defined repatriation protocol should be developed to ensure that any Maleo individuals seized in transit or at destination are returned promptly and safely to their native range in Indonesia, rather than being held in rescue centres in countries other than where they are native. While repatriation is at times implemented for certain high-profile species, such as orangutans *Pongo* spp. (Onraizal 2026), it remains inconsistently applied across most taxa. In practice, many species are not repatriated, reflecting broader challenges in managing confiscated wildlife under existing frameworks (Saito 2025).

The global trade in wildlife, particularly for exotic pets, is an extremely damaging and increasingly unsustainable industry that drives species toward extinction, degrades ecosystems (Mozer &

Prost 2023) and frequently involves animal welfare concerns and high levels of mortality (Wyatt *et al.* 2022). Tackling this global crisis demands far greater effort from national governments, including robust legislation, effective enforcement, cross-border cooperation and widespread public awareness campaigns. Without immediate and coordinated action, species like the Maleo, with highly specific reproductive ecology, may be continually pushed towards extinction, and the broader consequences for global biodiversity could be severe and irreversible (Senior *et al.* 2024). Finally, we recommend that the IUCN Red List assessment for Maleo be updated to explicitly include international trade across all use and trade categories. This revision is essential to strengthen protection arguments, as it is clear that international trade is now an emerging and significant threat to the species' ongoing survival.

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