Journal of

Indonesian Natural History

December 2018 Vol.6 No.2

Journal of Indonesian Natural History

The *Journal of Indonesian Natural History* is published biannually by the Department of Biology at the Andalas University, Padang, Sumatra Barat, Indonesia, in collaboration with Copenhagen Zoo, Denmark. The Department of Biology at Andalas University is dedicated to educating Indonesian biologists in the study and conservation of Indonesia's biodiversity and natural history. Copenhagen Zoo, through its Research and Conservation Division, supports *in-situ* conservation in Southeast Asia by assisting local organizations and individuals who undertake research, capacity building and the implementation of conservation programmes and projects.

The *Journal of Indonesian Natural History* is published by the Department of Biology, Andalas University, Indonesia in collaboration with Copenhagen Zoo, Denmark. It is an open access journal available at: http://jinh.fmipa.unand.ac.id

Cover photo: The "fur" and compound eyes of a moth species in the highland of Sarawak, north Borneo © Carl Traeholt, Copenhagen Zoo.

Guest editorial

Human – Animal Studies in Indonesia: An open field for multidisciplinary research and intervention

Puspita Insan Kamil[1,2]*, **Harry Susianto**[1] and **Adrian Dwiputra**[3]

[1]Faculty of Psychology, Universitas Indonesia, Kampus UI Kota Depok, Jawa Barat 16424, Indonesia
[2]Komodo Survival Program, Jl Tegal Wangi II, Gang Kubusaba no 11, Denpasar, Bali 80223, Indonesia
[3]Ecological Modelling Unit, World Agroforestry Centre, Jalan CIFOR, Situ Gede Sindang Barang, Bogor, Jawa Barat 16115, Indonesia

Corresponding author: Puspita I. Kamil, e-mail: *puspita.kamil@komododragon.org / puspitainsankamil@gmail.com*

Animals have been an indispensable part of human lives for thousand years, yet the kind of relationship between human and animal just began to gain attention from scientific communities in the 20th century. In 21st century, research concerning the interactions between human and animals, including habitat protection, animal welfare, and a vegan lifestyle expanded rapidly in Western culture (Wilcox, 2015), conducted under various fields of social (Amiot & Bastian, 2014). In 2010, the field of "anthrozoology" appeared and - often referred to as "Human-Animal Studies" (HAS) - was defined as the new interdisciplinary science that focuses on the relationship-interactions between humans and animal (Herzog, 2010). HAS continue to grow in countries like the United States, New Zealand, Canada, Australia and throughout Europe, where the trend primarily involves domestic animals and topics like Animal Assisted Therapy, animal welfare, or human-animal bond (Shapiro and DeMello, 2010).

Apart from human interaction with domesticated animals, the "morphology" of interaction with wild animals remain understudied, as pointed out by Amiot and Bastian (2014), who reported that, unlike studies on human relationship with cat or dog, only three out of total of 199 empirical psychological HAS articles reviewed focused on human-wild animal relationship. The extinction of species from anthropogenic causes continues at alarming rate in various places on earth and a better understanding of how and why humans behave towards wild animals can provide important information to help plan for better management and conservation intervention.

Despite being the World's second richest biodiversity country, Indonesia suffers an alarming biodiversity and habitat loss, averaging 47,600 ha primary forest per year between 2000-2012 (Margono et al., 2014). Habitat loss, poaching and human-wildlife conflict have driven many species to the brink of extinction. Hunting for mammals and birds has reduced abundances in the tropics by 58% and 83%, respectively (Benítez-López, et al., 2017). Understanding drivers of such behaviour, i.e. how or why humans have specific attitudes toward wild animals, is vital to prevent further species loss in the future. The development of HAS in Indonesia as a multidisciplinary research subject that focuses on wildlife diversity crisis will most likely contribute positively to finding better solution to prevent the ongoing species extinction crisis.

The main differences between HAS development in developed countries and Indonesia relates to the kinds of relationship that are formed between humans and wildlife. In Indonesia, many citizens still struggle to fulfil basic livelihood needs and Animal Assisted Therapy is considered an exotic and unnecessary privilege. Social scientists who consider to do research in HAS might be interested to explore more on two relationship types: food and pest.

Bushmeat consumption is often a means for financially disadvantageous citizens to get nutritious and relatively cheap food. In the 21st century, however, there are many other local options for food available in Indonesia and consuming wildlife appears unjustified. For example, the exceptional case of consuming the yaki (*Macaca nigra*), the critically endangered Celebes crested macaque protected under the National Decree, as ceremonial food on traditional holidays is not linked to nutritional needs (Melfi, 2010). The "Moral Foundation Theory" argues that humans are the only species that

develops a feeling of disgust, which contributes to our negative attitude towards cannibalism (Haidt, 2012) and other species that are unfamiliar to us. In addition, humans find it difficult to consume wildlife they see as intelligent with emotional attributes (Bastian, et al., 2011; Bilewicz et al., 2011). Yet there remains little research available that assess the effect of manipulating humans perception of the animals' intelligence to humans' intention to eat the animals in Indonesia.

Many in Indonesia consider Sumatran elephants (*Elephas maximus ssp. sumatranus*) a pest, because they have destroyed at least 20 houses, killed 2 people, injured 1 person, and damaged plantations around Bukit Barisan Selatan National Park (Sitompul, 2004). This conflict reduces local peoples' support to elephant conservation (Nyhus et al., 2000). Orangutan and Buton macaque are also known for crop-raiding activities (Meijaard, et al., 2011; Riley and Priston, 2010). In addition to crop-raiding, livestock depredation conflicts are common when local communities live in habitats with large carnivores such as tigers (*Panthera tigris sumatrae*). HAS can help identify solutions by shifting communities' mindset and negative attitude towards wildlife competitors and support conservation in addition to the more traditional strategy of providing only external support e.g. compensation and removing conflict animals.

While food and pest challenges are categorised as resources conflicts, illegal wildlife trade for companionship, medicine and symbol values are triggered by other drivers than primary needs. In some circumstances, such practice also violates the species protection law (National Decree No. 5 year 1990), which prohibits the possession of protected wild animals without legitimate permit, as in the case of possession of slow loris (*Nycticebus* sp.), an endangered Indonesian native primate species (Nekaris et al., 2013). Being illegally captured as pet as well as for traditional medicine, the species faces risk of extinction. The practice of keeping slow loris gained sudden popularity after a video depicting a "cute" slow loris tickled by its owner went viral on the internet. Comments from viewers suggested that people associated the animal with anthropocentric feelings and were keen to buy it (Nekaris et al., 2013). From being an obscure animal, the "cute" video created a huge demand for slow lorises as pets overnight.

Many Indonesians keep wild animals as symbols or ornaments. Colour features and attractive vocalisation are in high demand. Jepson and Ladle (2005) found that bird-keeping is important to many people in Indonesia with one in every fifth person kept birds (21.8%). This is in stark contrast to the number of people keeping chicken (16.6%), fish (9.5%), cat (3.4%) and dog (2.7%) (Jepson and Ladle, 2005). To be able to supply this huge demand for songbirds, many local communities in Java harvest songbirds from the wild without being aware that populations of a range of species have declined significantly. Keeping birds in cages is specifically important in Java, where a bird in a cage symbolizes a balanced life. Whereas many poor communities supplement income from bird hunting, bird ownership is generally associated with better educated and richer households (Jepson and Ladle, 2005).

In a nation with so many human-wildlife challenges, HAS must focus on bringing multi-disciplinary disciplines together and designing studies that examine the complex interaction between humans and animals and, in particular, find effective solutions to sustainable use. In this, it is important to include the "human element" as an integral part of conservation action, since humans are almost always the key reasons for species decline (Ariefiandy, et al., 2015; Kamil, et al., 2014). A key role for social scientists in HAS is to provide a robust understanding of humans' behaviour and attitudes, so conservation scientists can develop better and more effective conservation action plans. Working together, HAS will be able to progress as a new field to help safeguard biodiversity in Indonesia.

References

Amiot, C. E. and Bastian, B. (2014). Toward a Psychology of Human–Animal Relations. *Psychological Bulletin* **1-42**. doi:http://dx.doi.org/10.1037/a0038147

Ariefiandy, A., Purwandana, D., Natali, C., Imansyah, M. J., Surahman, M., Jessop, T. S. and C. Ciofi (2015). Conservation of Komodo dragons *Varanus komodoensis* in the Wae Wuul nature reserve, Flores, Indonesia: a multidisciplinary approach. *International Zoo Yearbook* **49**: 1-14.

Bastian, B., Loughnan, S., Haslam, N. and H.M. Radke (2011). Don't mind meat? The denial of mind to animals used for human consumption. *Personality and Social Psychology Bulletin* **38(2)**: 247-256.

Benítez-López, A., Alkemade, R., Schipper, A. M., Ingram, D. J., Verweij, P. A., Eikelboom, J. J. and M.J. Huijbregts (2017). The impact of hunting on tropical mammal and bird populations. *Science* 180-183.

Bilewicz, M., Imhoff, R. and M. Drogosz (2011). The humanity of what we eat: Conceptions of human uniqueness among vegetarians and omnivores. *European Journal of Social Psychology* **41:** 201-209.

Haidt, J. (2012). The Righteous Mind: Why Good People are Divided by Politics and Religion. New York: Pantheon Books.

Herzog, H. (2010). Some we love, some we hate, some we eat: Why it's so hard to think straight about animals. New York: Harper Perennial.

Jepson, P. and R.J. Ladle (2005). Bird-keeping in Indonesia: conservation impacts and the potential for substitution-based conservation responses. *Oryx* **39(4)**: 1-6.

Kamil, P. I., Makmur, A. R., Febrianto, P. A., Sutowireno, D. Q., Aviantoro, D., Hadiono, D. H. and A.J. Pratama (2014). Social-psychological intervention on conservation program through web 2.0: Case study of Kukangku. Asian Primates International Symposium (p. Poster Presentation). Bogor: Kyoto University & Institut Pertanian Bogor.

Margono, B. A., Potapov, P. V., Turubanova, S., Stolle, F. and M.C. Hansen (2014). Primary forest cover loss in Indonesia over 2000–2012. *Nature Climate Change* **4(8)**: 730.

Meijaard, E., Buchori, D., Hadiprakasa, Y., Utami-Atmoko, S. S., Nurcahyo, A., Tjiu, A. et al. (2011). Quantifying killing of orangutans and human-orangutan conflict in Kalimantan, Indonesia. *PLoS One* **6(11)**, e27491.

Melfi, V. (2010). Selamatkan Yaki! Conservationof Sulawesi Crested Black Macaques *Macaca nigra*. In S. Gursky, & J. Supriatna (Eds.), *Indonesian Primates*, pp. 343-356. New York: Springer New York.

Nekaris, K. A., Campbell, N., Goggins, T. G., Rode, E. J. and V. Nijman (2013). Tickled to Death: Analysing Public Perceptions of 'Cute' Videos of Threatened Species (Slow Lorises – *Nycticebus* spp.) on Web 2.0 Sites. *PLoS ONE* **8(7)**, e69215.

Nekaris, K. I., Shekelle, M., Wirdateti, Rode, E. J. and V. Nijman (2013). *Nycticebus javanicus*. Retrieved June 15, 2017, from The IUCN Red List of Threatened Species 2013: e.T39761A17971158: http://dx.doi.org/10.2305/IUCN.UK.2013-2.RLTS.T39761A17971158.en

Nyhus, P. J., Tilson, R. and Sumianto. (2000). Crop-raiding elephants and conservation implications at Way Kambas National Park, Sumatra, Indonesia. *Oryx* **34(4)**: 262 - 274.

Riley, E. P. and N.C. Priston (2010). Macaques in farms and folklore: Exploring the human–nonhuman primate interface in Sulawesi, Indonesia. *American Journal of Primatology* **71**: 1-7.

Shapiro, K., and DeMello, M. (2010). The state of human-animal studies. *Society & Animals* **18(3)**: 307-318.

Sitompul, A. F. (2004). Conservation implications of human-elephant interactions in two national parks in Sumatra. Graduate Thesis. Athens, Georgia: University of Georgia.

Wilcox, B. (2015, March 25). History of the human-animal relationship is key to nature preservation, Stanford scholar says. Retrieved June 6, 2017, from Stanford News: http://news.stanford.edu/2015/03/25/beasts-and-books-032515/

News and Notes

Journal of Indonesian Natural History going online

Carl Traeholt and **Wilson Novarino** (Eds.)

It is with great pleasure that we can announce that the Journal of Indonesian Natural History (JINH) will now go online. After five years of building the JINH, where the journal relied on a temporary home-page without online submission systems, it is now time to take it online. This follows our original intention i.e. to make it fully anchored and home at Andalas University. The entire process of migrating the JINH, setting up the new online submission systems, testing it and being ready to receive submissions does not happen by itself overnight. It has resulted in a few delays of getting Vol 6(2) uploaded. Therefore, Vol 7(1) and Vol 7(2) will appear as one Volume. We hope it has been worth the wait and are now proud to announce that JINH's new online submission system is ready. Manual submissions to the editors is still possible too.

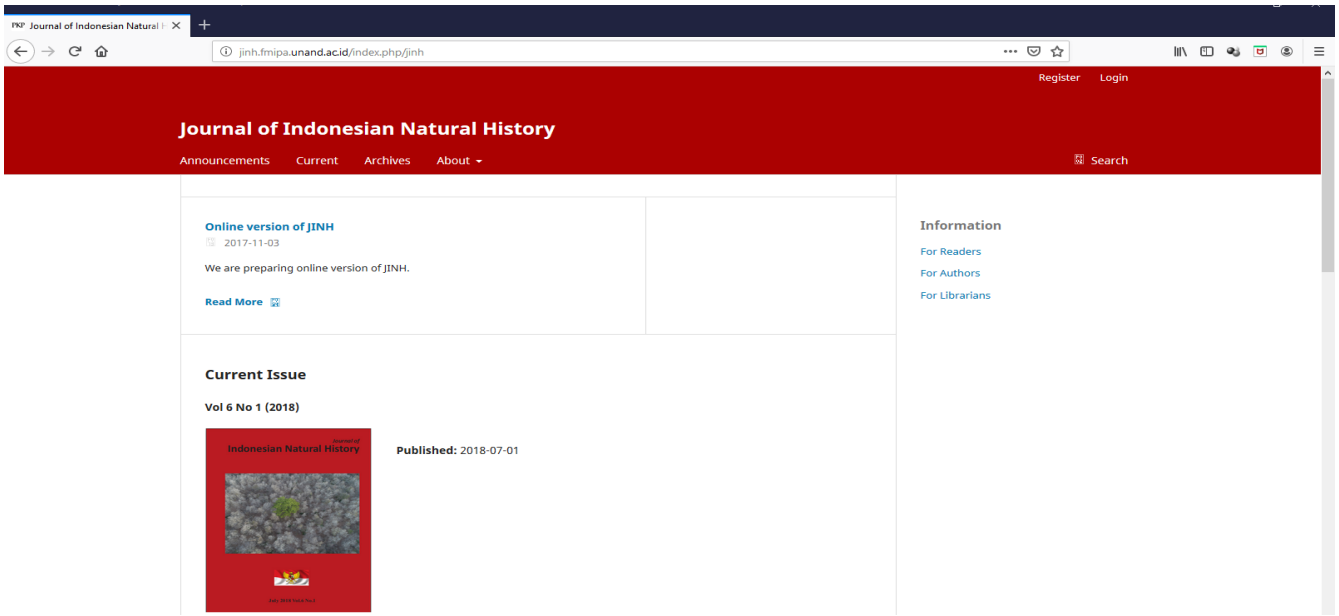
In the process of bring JINH online, Dr. Aadrean has taken up the task as "Editorial Manager" and will be responsible for JINH's online platform. He will continue to play an important role in keeping track of JINH that will also appear on Google Scholar.

JINH has also obtained its online ISSN number and, together with the printed ISSN, JINH's contributions will be searchable through the international search engine, giving JINH a much wider and Global outreach.

JINH's website and online submission portal is:
http://jinh.fmipa.unand.ac.id

Submissions can still be directed to the editor(s) at:
jinh@sci.unand.ac.id

For comments to JINH's website, reporting portal issues and other issues, emails must be addressed to the Editoral Manager at:
editorjinh@gmail.com



Sumatran tiger under threat

The Critically Endangered Sumatran tiger continues to suffer population decline. According to local authorities, a pregnant tigress with two cubs was found dead in the Indonesian province of Riau after being caught in a pig trap. The tigress, aged about 4 years, was reportedly trapped earlier this week around the 26th September, managed to escape but was found dead in a ravine about 150 metres (500 feet) from the trap with part of the snare wrapped around its body. A necropsy revealed that the tigress suffered a ruptured kidney.

The pig-snare was set by a local villager, a common way for communities to obtain additional food supply. The villager who admitted to setting traps was detained for interrogation.

Sumatran tigers, the most critically endangered tiger subspecies, are under increasing pressure as their jungle habitat continue to decline and poaching combined with bi-catches in snares set for other wildlife species take a huge toll on the population.

Indonesia take action against illegal wildlife trade

Indonesia became a signatory to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) in 1978, which entered into force on the 28th March, 1979. Despite its 40th anniversary, illegal wildlife trade seems to thrive better than ever in Indonesia. The anniversary was commemorated as National Fauna and Flora Day (known locally as Hari Cinta Puspa Satwa Nasional/HCPSN) and was celebrated together with various local and international environment and conservation partners to raise awareness of the world's wild fauna and flora.

According to the International Enforcement Agency (IEA), the value of global trade in wildlife is equivalent to the value of human trafficking, narcotics and illegal weapons. The trade in protected animals has a complicated or covert transaction path and is more open through e-commerce, marketplace and social media channels. The WWF Living Planet Report 2018, launched globally in October, revealed that at least 60 percent of vertebrate animals have disappeared in less than 50 years. The main threats to the species identified in the report are directly related to human activities, one of which is wildlife trade due to high market demands for several species.

Indonesia is a source and also a market for illegal wildlife chain of custody in Asia. Loss of these animals have an impact on the sustainability of various key species in nature and collaboration between all parties is needed to take decisive steps to stop illegal wildlife trade. In this context, the public can play an important role in combating illegal wildlife trade by actively reporting crime and illegal wildlife trade to the authorities. This has been made much easier with the formation of the online E-Reporting of Protected Animals portal that is managed by the National Police Criminal Investigation Agency BARESKRIM POLRI. Reporting can now be done through applications for mobile phones, tablets and computers.

The "Indonesia Says No to Illegal Wildlife Trade" campaign was launched in Jakarta by a team of multi-stakeholders working in biodiversity conservation and sustainability in Indonesia, such as the Ministry of Marine Affairs and Fisheries, Indonesia's Police Force, Indonesia's National Army, Attorney General's Office, Corruption Eradication Commission, Financial Transaction Reporting and Analysis Center, House of Representatives, non-governmental organizations, religious leaders, art workers, and athletes. The ultimate goal of the campaign is reducing the wildlife trade by increasing public awareness and participation in reporting suspected illegal wildlife trade to BARESKRIM POLRI.) online through the E-Reporting of Protected Animal applications on mobile phones or computers tablet.

Asia remains the global centre for illegal wildlife trade for a variety of globally protected wildlife as a source, transit point and market destination for selling endangered and high-value wildlife.

Accelerating ice-melt on Greenland

A new study shows reiterate the effect of global warming on the Greenland ice-shelf. It concludes that from early 2003 to mid-2013, the total mass of ice in Greenland declined at a progressively increasing rate. The researchers used Gravity Recovery and Climate Experiment and global positioning system observations to record spatial patterns of the sustained acceleration and the abrupt deceleration in mass loss are similar. The strongest accelerations tracked the phase of the North Atlantic Oscillation. It revealed that the negative phase of the NAO enhances summertime warming and insulation while reducing snowfall, especially in west Greenland, driving surface mass balance more negative. The spatial pattern of accelerating mass changes reflects the geography of NAO-driven shifts in atmospheric forcing and the ice sheet's sensitivity to that forcing. While the mid-2013 saw an abrupt reversal and very little net ice loss in the next 12–18 months the authors conclude that southwest Greenland will become a major future contributor to sea level rise.

Bevis, M. et al (2019). Accelerating changes in ice mass within Greenland, and the ice sheet's sensitivity to atmospheric forcing. *PNAS* **116(6)**: 1934-1939.

Indonesian trade drives extinction of a songbird

The illegal wildlife trade in Indonesia has resulted in many recent extinctions of a variety of species. None seem as apparent as the illegal cage bird trade, which is increasingly recognised as a major impediment to the survival of a large number of songbirds. The authors focused on the black-winged mynas (*Acridotheres melanopterus*, *A. tricolor* and *A. tertius*), three species of Critically Endangered songbirds endemic to Indonesia. Only 20 years ago these species were not considered globally threatened but high levels of trapping from the wild for the largely domestic cage bird trade has brought all three species to the brink of extinction. It is estimated that less than 500 black-winged mynas remain in the wild. The study investigates the trade in black-winged mynas, online and in bird markets, and make an assessment of the role captive breeding played in the conservation and management of the species over the period 2009–2018. It showed that prices peaked in 2014 at US$140 per bird but has decreased to US$85 in 2018, which indicate higher supply and lower demand. Seven bird markets were in western Java and in 127/145 visits the authors recorded 1253 black-winged mynas for sale. Turnover was high, with 50% of birds sold after one week upon arrival in the market. This amounts to an estimated 1300- 2300 mynas sold annually in these seven bird markets with a retail value of US$170,000. Few birds had closed leg-rings, but were in all likelihood a combination of captive-bred, first-generation captive-born and wild-caught individuals; some appeared to be crossbreeds between the three recognised species. Including birds being traded on all markets in Java and Bali as well as a thriving online trade, hte authors estimated that the number of black-winged mynas in private ownership in Indonesia is in the order of 40,000 birds. They are concerned that without proper registration and regulation in the trade of captive-bred mynas, even a small amount of wild-caught birds entering this now substantial trade will act as a serious impediment to the conservation of black-winged mynas. With the species already being ecologically extinct, we anticipate that it soon will join the ranks of species like Père David's deer *Elaphurus davidianus* and scimitar-horned oryx *Oryx dammah* that are extinct in the wild but that have captive populations in the tens of thousands. To prevent the imminent extinction of black-winged mynas in the wild, the authors recommend (1) that the Indonesian authorities invest in more effective law enforcement and prosecution of lawbreakers; (2) establishing a multi-stakeholder three species black-winged myna management plan, in which commercial captive breeders participate; and (3) better coordination of reintroduction programmes.

Nijman et al., (2018). Wildlife trade, captive reeding and the imminent extinction of a songbird *Global Ecology and Conservation*. **15**: e00425

Bear trade in Lao

This study examines seizure data that implicates Lao People's Democratic Republic as a place of origin, transit point or destination of illegally-sourced live bears, their parts and derivatives, from 2010 to 2016. Intensive surveys of trade in 25 towns and villages carried out in 2016 recorded bear parts and derivatives for sale in more than half of locations surveyed, largely for use in traditional medicine. Live bears that were seized or surrendered to authorities were also analysed in the study, and of all cases combined, live bears accounted for more than half (62.7%). Live bears were mainly cubs, and intended for sale to primarily stock bear bile extraction facilities (bear farms). Four other countries were implicated in cases involving trade in bears, their parts or derivatives, with Lao PDR, including China, Myanmar, the United States of America (US) and Viet Nam. The authors conclude that Lao PDR remains a source of bears taken illegally from the wild, in Lao PDR and in neighbouring countries, and a hub of illegal wildlife trade. They also conclude that the study provides evidence of Lao PDR's ongoing and open trade in bears, their parts and derivatives, in direct violation of national legislation, and of the continuing violations against the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Gomez, L. and Shepherd, C. (2018). Trade in bears in Lao PDR with observations from market surveys and seizure data. *Global Ecology and Conservation* **15**: e00415.

Private landowners and species conservation

Species protection legislation has been used as one of the main approaches in conservation – yet in many cases there is only little information about the effectiveness and side-effects of such regulation. Noncompliance can limit effectiveness of legislative protection, and deliberate harmful actions by landowners have sometimes been reported as a response to restrictions. This type of response from private landowners is common across the world. In this study, the authors focused on the attitudes of 186 Finnish forest owners toward the protection of Siberian flying squirrel *Pteromys volans* – a species which is protected according to the European Union Habitats Directive and is a well-known example for species protection in Finland. The study explored the attitudes and claims of harming protected species by comparing the responses of persons with and without direct experience of legal protection by structural equation modelling. The results suggested that experience did not explain forest owners' attitudes toward having the species in their forest. Claims of harming protected species were connected to policy attitudes and should be interpreted as a political phenomenon: they reflect political discourse on conservation policy and are a part of debate between stakeholders. Accidental and reckless noncompliance seem more important phenomena than intentional harming, especially as the chance in Finnish Nature conservation likely Act likely affects information of nest sites on logging areas. Other instruments than legislative protection of known nest sites might be more effective in protecting the flying squirrel population.

Jokinen, M. et al. (2018). Private landowners and protected species: What sort of noncompliance should we be worried about? *Global Ecology and Conservation* **15**: e00407

Trade in non-CITES listed species

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) aims to ensure that international trade does not further endanger species already threatened by trade. While the scale of trade in CITES-listed species is relatively well documented, trade in non-CITES-listed species is usually only collected when it concerns physical or online market surveys. In this study, the authors explore the challenges faced in monitoring trade in non-CITES-listed species based on available data. They found that data available on non-CITES-listed species are

confusing, irregular, and far from complete and can only provide an indication of the actual quantities traded. In addition, it is subjected to the willingness of individual countries to provide or record data. Limited availability of data on trade in non-CITES-listed species can impede conservation efforts, as the actual level of trade remains unknown and concerns are often undetected.

Janssen, J. and Shepherd, C.R. (2018). Challenges in documenting trade in non CITES-listed species: A case study on crocodile skinks (*Tribolonotus spp.*). *Journal of Asia-Pacific Biodiversity* **11(4)**: 476-481

Social media as an impediment to conservation

Social media has increasingly become the most common communication platform between people. Because of this, it is also being used extensively in business and trade and lately it has become an increasingly popular platform to trade legal and illegal wildlife too. The study explores the online trade of otters, a group of globally threatened taxa in Thailand, a country of high global social media use. The authors monitored five Facebook groups for a 14-month period to establish a primary understanding of the scope and scale of the trade. A total of 160 sales posts (337 individual otters) of two species, the Asian small-clawed otter (*Aonyx cinereus*) (81%) and the smooth-coated otter (*Lutrogale perspicillata*) (19%) were recorded. Newborn otter pups accounted for 53% of the offers, whereas young otters accounted for 35%. The average prices amounted to US$78, with the smooth-coated otter offered at significantly higher prices than the Asian small-clawed otter. Juvenile otters were also significantly more expensive than newborns. Trade appeared to be domestic; however, the potential for international trade cannot be overlooked. Although otters are protected domestically, the trade is easily accessible and prevalent. The results reflect current inadequacies in enforcement and legislation in keeping pace with the rapidly shifting nature of the Internet in Thailand and throughout the global Internet community. A consistent collaborative effort from consumers, enforcement agencies, and operators is required to address this illicit trade.

Siriwat, P. and Nijman, V. (2018). Illegal pet trade on social media as an emerging impediment to the conservation of Asian otters species. *Journal of Asia-Pacific Biodiversity* **11(4)**: 469-475

The gravity of wildlife trade

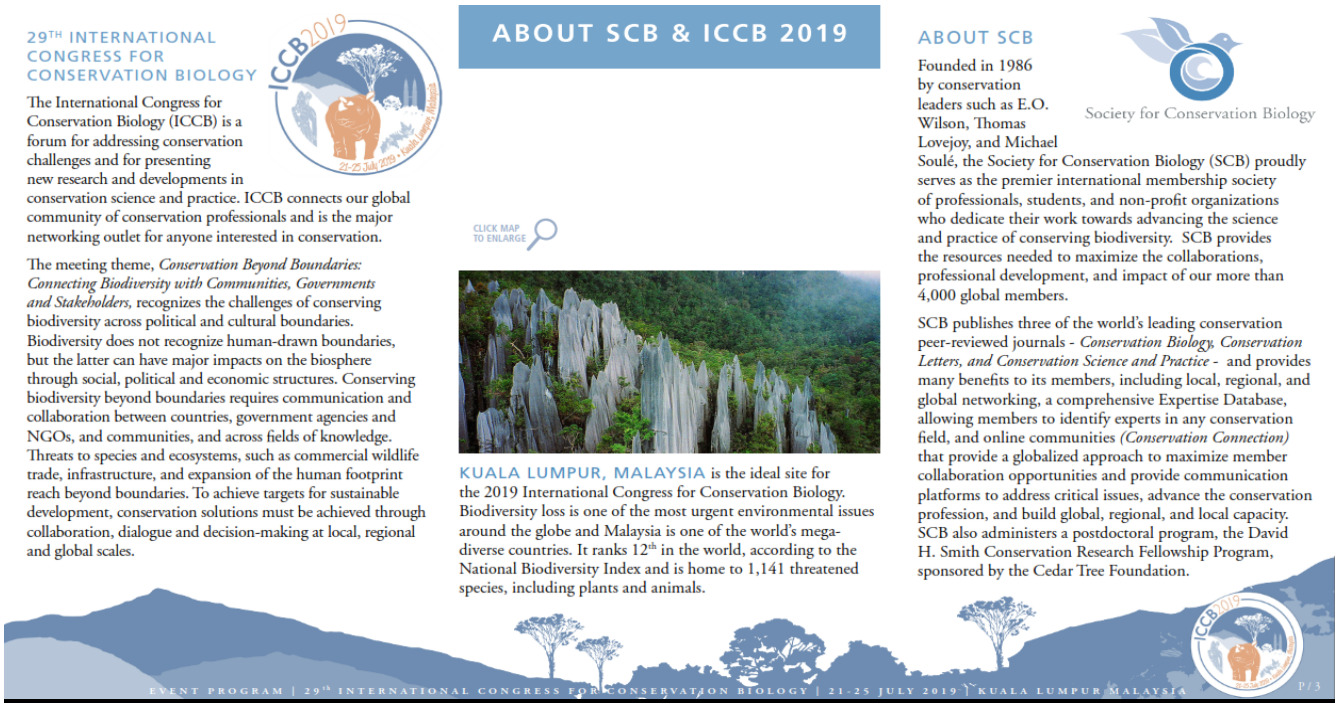
Unsustainable trade in wildlife products, both legally and illegally, is a leading cause of population declines and increased extinction risk in commercially valuable species. However due to the clandestine nature of illegal trade and limited studies of legal trade our general understanding on international trade networks is patchy. In this study, the authors develop a "gravity–underreporting modelling framework" that they used to analyse and compare: (i) data on the legal trade in mammalian, avian and reptilian products from recorded by The Convention on the International Trade in Endangered Species of Wild Fauna and Flora (CITES) and (ii) data on the seizures of illegal products entering the USA between 2004 and 2013. The results suggested there were substantial differences in the factors driving legal trade for the 3 taxonomic groups considered, indicating different drivers for different product markets. Illegal imports for all groups were associated with increasing exporter GDP. The authors found higher probabilities of underreporting for avian and reptile products, and in general central Africa, central Asia, Eastern Europe and Pacific Island states showed higher underreporting than other regions, indicating the existence of complex trade networks and the potential for the laundering of illegal products through legal markets. The results show the important regional and economic trends driving wildlife trade and the new modelling framework can also help illuminate previously unseen aspects of illegal and legal wildlife trade, which can help with the implementation of interventions to curb the impact of trade on wild populations

Symes, W.S. et al (2018). The gravity of wildlife trade. **Biological Conservation 218**: 268-276

40 years of Global wildlife trade

Wildlife trade can provide commercial incentives to conserve biodiversity but, if unsustainable, can also pose a threat. CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) aims to ensure international trade in CITES-listed species is sustainable, legal and traceable. However, large-scale temporal and spatial patterns in wildlife trade are poorly known. We address this by analysing the CITES Trade Database: >16 million shipment records for 28,282 species, from 1975 and 2014. Over this period, the volume of reported trade in CITES-listed wildlife quadrupled, from 25 million whole-organism equivalents per year to 100 million, and the ratio of wild- to captive-sourced trade in mammals, birds, reptiles, invertebrates and plants declined by an order of magnitude or more. Our findings start to reveal the scale of the legal wildlife trade, shifting trade routes and sources over time and we describe testable hypotheses for the causes of these changes

Harfoota, M. et al. (2018). Unveiling the patterns and trends in 40 years of global trade in CITES-listed wildlife. *Biological Conservation* **223**: 47-57.



The 29th instalment of the Society for Conservation Biology's International Congress for Conservation Biology will take place in Kuala Lumpur, Malaysia in 21-25th July, 2019. The event will be held at the Kuala Lumpur International Conference Centre and it is anticipated that it will attract up to one thousand participants from across the world.

Successful aerial survey using thermal camera to detect wild orangutans in a fragmented landscape

Bjorn Dahlen[1, 2] and **Carl Traeholt**[2]

[1]Pacific Aviation, LLC, PO Box 112, Cottage Grove, Oregon, 97424 USA
[2]Copenhagen Zoo, Research and Conservation Division, Roskildevej 38, 2000 Denmark

Corresponding author: Carl Traeholt, *E-mail: ctraeholt@gmail.com*

Abstract

Asia's only great ape, the orangutan, builds nests for the night in the upper rainforest canopy. Due to the location in the upper canopy, aerial surveys of orangutans rely primarily on counting nests. This method has come under increasing criticism, because nest decay rates can vary greatly over space and time and is depended on e.g. local climatic conditions, tree species and presence of termites and other animals. Whereas empty nests may not provide a good measure of presence, live orangutans in their nests does. Assuming the orangutan is the only animal species of the size that can be found in the upper rainforest canopy at night, we used thermal camera fitted to a drone to successfully detect and identify orangutan in Kumai Estate, Central Kalimantan, Indonesia. Our results provide an encouraging new census platform for conservationists and park managers.

Abstrak

Satu-satunya kera besar di Asia, orangutan, membuat sarang di malam hari pada kanopi hutan hujan tropis. Karena lokasinya di atas kanopi, survey udara untuk orangutan mengandalkan pada perhitungan sarang. Metode ini mendapat banyak kritikan, karena tingkat pembusukan sarang bisa sangat bervariasi tergantung pada kondisi tempat dan waktu serta tergantung misalkan pada kondisi iklim setempat, jenis pohon, keberadaan rayap atau serangga serta hewan lainya. Sarang orangutan yang kosong tidak memberikan informasi yang cukup jelas tentang keberadaanya, tetapi kalau orangutan ada di atas sarangnya tentu saja bisa. Dengan asumsi orangutan dengan ukuran tubuh yang dimilikinya, adalah satu-satunya jenis dapat ditemukan di atas kanopi hutan tropis pada malam hari, kami menggunakan termal kamera yang dipasang pada drone telah berhasil mendeteksi dan mengidentifikasi orangutan di perkebunan Kumai, Kalimantan Tengah, Indonesia. Hasil kami memberikan platform sensus baru yang menggembirakan bagi para konservasionis dan pengelola kawasan.

Keywords: Orangutan, FLIR, thermal camera, drone, survey, Indonesia

Introduction

Using consumer drones fitted with a thermal camera to detect and estimate mammals in the wild is an opportunity that has emerged only in the past decade. A major challenge in studying mammals in the field is finding them and because ground-based observation of wildlife is often limited by access and topography, aerial surveys are often the only practical way to detect and estimate a target species' numbers. Small air planes have been used for aerial detection and population surveys of a range of wildlife species for years, for example, caribou (Courtois et al., 2003; Neufeld and Vennen, 2015), water birds (Chabot and Bird, 2010), elephants (Vermeulen et al., 2013), dugong (Hodgson et al., 2013) and sea turtles (Bevan et al., 2015). Forward-looking Infrared (FLIR) cameras were tested in aerial surveys in the 1960-70s (Croon et al., 1968; Parker and Driscoll, 1972), but it was only in the 1990s that FLIR had become sufficiently advanced for effective application in aerial wildlife surveys (Boonstra et al., 1994; Haschberger et al., 1996; Wiggers and Beckerman, 1993). The downside was the combined cost of adequate

Submitted 6th November, 2017. Revision submitted 30th January, 2018. Revision accepted 5th April, 2018

FLIR technology and flying time, which made it prohibitively expensive for most users. The past 10 years has seen the emergence of mainstream drone technology (Anderson and Gaston, 2013; Bevan et al., 2015; Gonzalez et al., 2016), which has paved the way for endless new aerial FLIR applications, such as disease detection in wildlife (Dunbar and MacCarthy, 2006; Dunbar et al., 2009), mammal surveys (Dunn et al., 2002; Storm et al., 2011; Vermeulen et al., 2013), detection and location of polar bear dens (Amstrup et al., 2004), survey of other wildlife species (Christiansen et al., 2014; Franke et al., 2012), rhino protection (Mulero-Pazmany et al., 2014) and law enforcement activities (Gonzalez et al., 2016).

Aerial population surveys of great apes are rare, because all species live in rainforest habitat, where a thick canopy shades them from visual detection. Furthermore, aerial surveys are expensive and good high-resolution satellite images are limited and often costly too. Tests in Tanzania and Gabon involving the detection of chimpanzee nests and fruiting trees were undertaken recently using a camera fitted to a drone were successful although with a high-degree of misidentification (Bonnin et al., 2018; van Andel et al., 2015). Asia's only great ape, the orangutan (*Pongo spp.*) was surveyed in 1986 (Payne, 1987), using helicopter to count nests as they are easily detected from the air and, subsequently, aerial nest counting became common practice, using a similar technique or combining it with ground counts (Ancrenaz et al., 2010; Ancrenaz et al., 2005; Ancrenaz et al., 2004a; Felton et al., 2003; Johnson et al., 2005; Meijaard et al., 2010; Russon et al., 2001). The cost of aerial surveys remained prohibitive until a preliminary survey using drones to assess the distribution and density of Sumatran orangutan was successful (Wich et la., 2015) and allowed for possible future cost-reduction. While surveys using fixed-winged drones fitted with daylight cameras can cover large tracts of land, challenges persist with regards to detection reliability, speed and altitude. In addition, the counting ape nests is associated with a number of variables that are difficult to predict and estimate, for example, nest decay rates vary greatly over space and time and is dependent on a range of variables such as local climatic conditions, tree species, presence of termites and other animals and degree of nest re-use (Cheyne et al., 2013; Felton et al., 2003; Husson et al., 2009; Wich and Boyko, 2011). Recent studies have recommended abolishing the use of single-number decay time estimates for the estimation of orangutan populations (Marshall and Meijaard, 2009; Mathewson et al., 2008; Spehar et al., 2015; Wich and Boyko, 2011). Whereas direct nest counts can be difficult and success is dependent on picture resolution, flying altitude and speed, counting orangutan in nests at night, using FLIR fitted to a drone, will provide a new and complimentary method to increase the accuracy of population estimates, perhaps with a potential for near absolute population counts.

To our knowledge, this is the first of its kind that uses FLIR fitted onto consumer-range drones for detecting and/or estimating orangutan populations in the wild.

Methods

Assumptions

Orangutans, males and females, build nests in the upper canopy. In our population estimate, we assume that all individuals that sleep in the canopy are detectable with a FLIR thermal sensor. Assuming that a majority of orangutans sleep in a nest in the canopy, this approach to orangutan survey can add significant additional accuracy to population counts in those two forests blocks and other orangutan habitats.

Drone platform

We used two DJI drones as aerial survey platforms (hereafter "drones"). The first was DJI Phantom 4Pro (P4P) with a 24mm, f2.8 on board RGB camera. The 1" sensor supports 4K video and 20 megapixel still pictures. The P4P has a limit of approx. 25-30 minute flying time and we tested the video transmission range from drone to controller

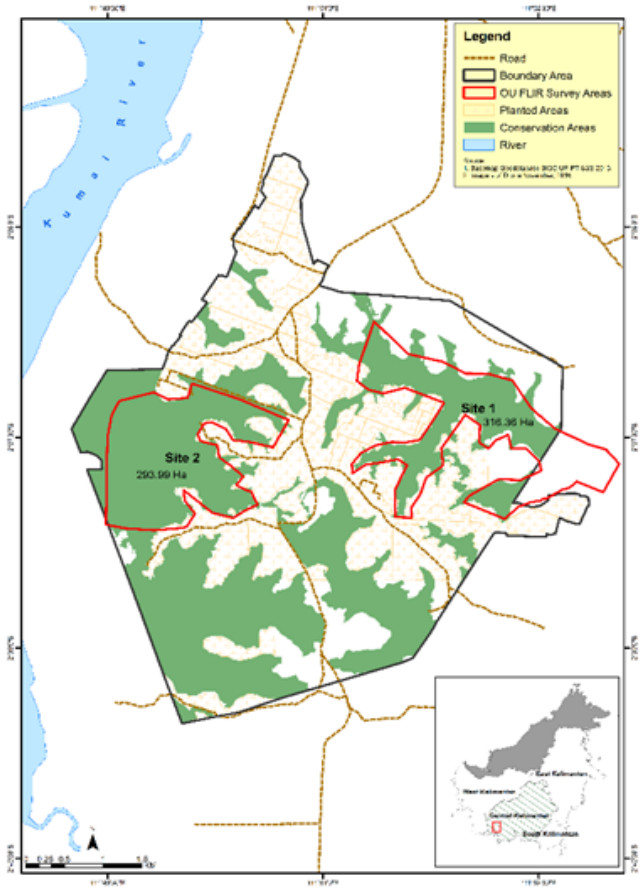


Figure 1. Our study sites in a fragmented forest landscape with known presence of orangutan.

to be well above 2.5km, while flying at 150m above local canopy height. The range of the live video transmission varies based primarily on the flying altitude. Flying lower generally reduces the range. Actual range depends on local conditions such as canopy density, location of the receiver, and electromagnetic interference. The second drone was a DJI Inspire 1 V2.0 with DJI TB48 battery, which has a flight time of 13-15 minutes. The standard Zenmuse X3 camera and gimbal is interchangeable with a Zenmuse XT 640 Pro thermal camera (FLIR) with built-in gimbal. The range of video transmission was in excess of 2.5km at 100m above the local canopy height in this location. We used an Apple 9.7" iPad (128GB, Wi-Fi + 4G LTE) as our live-feed screen for both systems.

FLIR setup

We custom fitted a FLIR™ 640 Pro 9 Hz camera with 13mm lens to the P4P behind the on-board camera. To prevent the on-board camera from shielding the FLIR camera, the FLIR camera was mounted on a separate 2-axis gimbal with tilt/roll that extended below the on-board camera. The gimbal is necessary to reduce vibrations in the video and still pictures and to keep the image frame horizontally stable. This imaging system was setup independently of the P4P electric system to prevent unnecessary drainage of the main flying battery. The system was powered by a self-contained 9V rechargeable battery providing approx. 15-20min of gimbal power. The addition of the FLIR camera and gimbal required a 7cm extension of the drone's landing gear to prevent the FLIR camera from touching the ground during landing and when stationary. We used an additional 900MHz transmitter with a 5" screen in order to see live FLIR video feeds using this system (separate from the iPad). The live video stream range of the FLIR system was approx. 750m at 150m above local ground level. The FLIR 640 Pro camera records 8-bit digital video in MJPEG or H.264 formats and 14-bit still imagery to a removable micro-SD. The camera is controlled over Pulse Width Modulation commands, enabling the operator to select colour palettes, start and stop recording, or trigger the camera in-flight using the radio controller. The thermal image could be adjusted between "white hot", "black hot" and "colour". The "white hot" setting provided the best visual detection of heat signatures in the rainforest canopy and was used for both video and still images.

The second drone was a DJI Inspire 1 fitted with a Zenmuse XT 640x512 9Hz thermal camera with a 9mm lens that is fully integrated on a 3-axis gimbal. The thermal sensor used for the Zenmuse XT is the same as the FLIR VUE 640 Pro used with the P4P but it is integrated for use with DJI drones. Thus, both the drone and camera controls are operated using the DJI GO application on an iPad. Images and video are recorded to an on-board micro SD card and live video feed is transmitted using the DJI Lightbridge software and displayed on the iPad. This system provides a single interface for

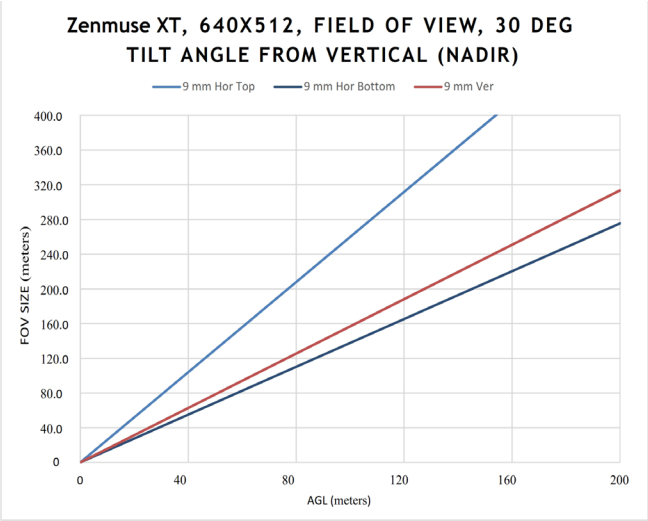


Figure 2. Maximising the field-of-view. We maximised the field-of-view (FOV) by recording video and stills at a 30-degree angle.

control of the drone and the camera with additional features for changing palette colour options in-flight and integrated GPS position stored in EXIF.

The Inspire 1/Zenmuse XT 640 combination has several important advantages over the P4P setup. Although both systems use the same FLIR thermal sensor with a resolution of 640x512 pixels, the Zenmuse XT camera is able to record video and take still pictures at the same time. It also records GPS location in the thermal image EXIF file, which reduce the amount of post processing necessary. This system also permits the operator to use real-time digital zoom at 2x, 4x, or 8x. Image signal transmission from the thermal camera to the remote pilot's live feed screen on the iPad is significantly better with the Inspire 1 using DJI Lightbridge technology compared with the 900Mhz transmitter used with the P4P. "White hot" was also used for the image and video recording using this system but the same palette of colours is available to the operator.

Basic photogrammetry techniques were used to determine the approximate size of the hot spots given the flying height of the FLIR thermal sensor and the height of the canopy. For example, if the sensor height was 60m and the canopy height was 20m, the relative distance from the sensor to the hot spot would be approximately 40m. At this distance, the thermal sensor horizontal field of view (FOV) would be 55m at the canopy (using a 9mm lens) and the vertical FOV would be 42.5m. Thus, at 40m each pixel has ground sample distance of 8.6cm (horizontal) by 8.3cm (vertical). A cluster of ten pixels then has ground spot distance for measurement (target subtends 10 pixels) of just under 1m. There are very few arboreal mammals in Southeast Asia with a heat signature of approximately 36 degrees C that would even come close to emitting a $1m^2$ thermal signature. A large male proboscis monkeys, *Nasalis larvatus*, could emit close to $1m^2$, but with a long tail and mostly quadrupedal they are easily discriminated from orangutans. The survey team was comprised of an experienced wildlife biologist and a drone pilot experienced in aerial survey, thermal imaging and photogrammetry. The wildlife biologist acted as visual observer and they both monitored the live feed while the pilot was flying. If there was any doubt whether the thermal image was of an orangutan based on size and body motion, the drone was repositioned for a closer look to confirm.

Study sites

Drone flights were performed in United Plantations' "Kumai Estate", Central Kalimantan, Indonesia (Lat: -2.627644, Lon: 111.831075) (Fig. 1) in an area where the presence of orangutans is known over the course of 4 days. Two fragmented forests sites, Site 1 (316.36 Ha) and Site 2 (293.99 Ha) (Fig. 1), were surveyed thermal imaging.

Day 1) At Site 1, three planned flights at 1.5-2.5km, 200m and 100m above ground level (AGL) were performed as well as three opportunistically after 20:00 and at 22:00 local time, using the P4P system and video setting to record each flight while monitoring the live feed. The primary objective of these flights was to scout for possible orangutans in their nests and to verify that the settings used would provide good discrimination between orangutans and the forest canopy. While the 200m flying altitude provided excellent signal transmission and coverage of a large area per flight, the 100m flying altitude provided the optimal balance between transmission range, video/image resolution and the area covered per flight.

Day 2) Five flights were performed in Site 2 between 20:30-22:30 local time at 60m AGL using the P4P system. If the FLIR signal returned a white-hot-signal in the canopy, we made a low-pass fly-over at approx. 30m AGL to identify the source of the signal and recorded video sequences as well as still-pictures of the object. Videos and still pictures were reviewed in the field on a laptop. Post-processing of the imagery was required in order to determine the lat/long coordinates of the orangutan nests.

Day 3) Eight flights were performed between 20:00 and 01:00 local time using the Inspire 1 system flying at 60m AGL. Flights were carried out over two fragmented forest blocks in pre-planned flight transects with >20% average side overlap in the sensor field of view to ensure 100% coverage of the study areas. When a "white-hot-signal" was detected, still images and video were taken with the GPS position embedded in the image EXIF. Oblique video and still images were recorded at an angle 30 degrees up from vertical (slightly forward looking) allowed the pilot and visual observer to see into the secondary forest and below the canopy, minimizing the chance of false positives or "hot spots" concealed by vegetation. The distance at which "hot spots" could be detected depends on the environmental conditions, including canopy density, temperature of the forest and location of the orangutans in the canopy. This approach also enabled the survey team to view farther in front of the platform with increasing field of view, optimizing the resolution at the horizontal bottom of the image and enhancing the field of view at the top of the scene (Fig. 2). Parallel opposing flight paths were spaced 80m apart, resulting in a minimum overlap of 20m between the transects at the average field of view (FOV). Flying transects with opposing flight lines minimizes the chance of an orangutan being concealed by vegetation. Viewing live video allowed the survey team to see movement and positively identify several of the "hot spots" as orangutan by characteristic motion and outstretched limbs. The orangutans did not display any aversion to the drone flying between 30-40m overhead. Movements were observed to be casual and none of the orangutans attempted to leave their nest or conceal themselves. As the onboard GPS records the image location in the EXIF data of each photo with this system, verification of the location and flying subsequent

Figure 3. First thermal image of a wild female orangutan. A female orangutan embracing her infant in their nest approx. 25m above ground level.

Figure 4. A thermal image of three orangutan hot spots. that were verified by measurement of body size and true colour images of nests in the same location the following morning.

sorties using either thermal or RGB camera to the actual location of the orangutan sighting did not require post-processing of the imagery. The camera was tilted to vertical while hovering overhead each suspected or known orangutan and an image was captured for measurement of pixel sizes.

Day 4) Before sunrise the next day (05:30 local time), we revisited the same locations at where "white-hot-signal" were recorded in an attempt to verify the presence of orangutans and/or nests before they left the nests. We prepared the Inspire 1 drone for flight while it was still dark and attempted to fly over the nests where orangutans had been observed at night while taking true colour images of the area of interest as soon as there was enough light to take pictures. The true colour images were acquired using >60% overlap between adjacent images so they could be used to create a digital surface model of tree canopy structure and measure tree and nest height. Due to low clouds over the canopy, we did not observe any orangutans still in the nests with the true colour images/video that morning. When the clouds dissipated at 07:45 we were able to record images of the nests, where they were located the night before using the GPS referenced thermal camera images. However, by this time, the orangutan had already left their nests.

Results

Orangutan identification

The test flights confirmed the usefulness of FLIR to identify orangutans in nests at night. This was successful using both the P4P and the Inspire 1 drones. The test flights recorded several heat-signals that could easily be identified as orangutans based on body size, body heat, location and, in many cases, movements within the tree canopy. When operating the P4P, we used the two nearest points from the access road for low-pass flying and recorded both video and still pictures of a nest with a female with her infant and a nest with a single individual (Fig. 3). The closest distance between a drone and an orangutan was approximately 20m. None of the orangutans observed during these surveys appeared to be disturbed by the sound of the drones. While multiple techniques were used to confirm the presence and location of the orangutans in the survey areas, visual cues were the primary indicators. All of the orangutans, which were identified using the Inspire 1 system were initially detected in the thermal live view video on the iPad when the distance between the drone and the orangutan was in excess of 150m. In several cases, when the orangutans were located high in the canopy and the background forest temperature was significantly cooler (late at night), the initial sighting of a large "hot spot" (potential orangutan) occurred when the drone was in excess of 400m from the "hot spot". In these situations, the "hot spots" were approximately 10-12 degrees Celsius warmer than the forest and they appeared very bright and easily visible from a distance. When these "hot spots" were seen, the drone could easily be repositioned to confirm if it was an orangutan, with thermal video and still images.

Population estimates

There were no orangutan heat signals identified in study Site 1 but a total of 7 orangutans were observed in study Site 2 during one night of aerial thermal surveying (Fig. 4). Orangutans were detected using both drone systems, however, with the P4P being used for the low passes and the Inspire 1 for higher altitude flying. The P4P is significantly cheaper than the Inspire 1 and, consequently, we chose to use this for "riskier" test flights, whereas the Inspire 1, with its better range and higher resolution live-video transmission, was used for higher altitude flights.

In situations where we did not positively identify orangutans visually using the thermal camera, we recorded the GPS location of the hot spot, measured it based on the pixel size to verify that it was orangutan size and then flew to the same location the following morning, using a true colour camera to either observe that there was a fresh nest in the same location as the recorded "hot spot".

In every incident, there was a fresh nest in every location where a likely orangutan heat signal were recorded.

Discussion

This study successfully demonstrated that using thermal camera fitted to a consumer range DJI-drone can detect and identify orangutans in their nests, thereby also providing useful additional tools to estimating orangutan population in relatively small forest areas. We did not encounter difficulties in identifying orangutans from detected heat signal, most likely because of its large size. We experienced better detection probability after midnight until before sunrise, because the difference between the ambient temperature and a warm-blooded animal is highest, creating a clearer heat signal. At early evenings, 3-4 hours after sunset, many trees remained sufficiently warm to emit heat signals and create "false" detections. However, such false "detections" were usually easy to identify, due to their narrow linear features.

The primary weakness associated with using thermal camera fitted to a drone for orangutan population estimates is that we assume that all orangutans sleep in nests in the canopy. At this point in time, we are not aware of how big a proportion of orangutans in a population sleeps in nests and how many that do not sleep in nests. If "canopy nest sleepers" approximate all individuals in a given population, the survey technique can potentially provide accurate population estimates on its own. The accuracy, however, declines with a lower proportion of the population that are "canopy nest sleepers", although it will still provide a very important compliment to nest-counts from the ground.

Expanding on this study, we will use thermal cameras to compliment "traditional" nest counts and cross reference these with daily overflights over a period of time to better understand if some orangutans are permanently "ground sleepers" and others permanently "canopy nest sleepers" and, if so, the ratio between nest-sleepers and ground sleepers. In addition, orangutans staying on the ground or building nests at the lower part of canopy can still be detected, although the heat-signal may be so small that the risk of misidentifying it as a different or smaller animal species increases. If there are any identification uncertainties, closer inspection in real-time by repositioning the drone (e.g. we saw a few bearded pigs on the forest floor but were easily able to identify them by body shape and movement) or by follow up censuses using true colour aerial imagery or ground based surveys can eliminate this bias. It requires, however, that the observers continue to watch the detected object until sunrise. In the immediate future, we plan to carry out additional surveys with two teams to test the efficiency and complementarity of using the methods described in this study i.e. one team will use standard nest counts while the other uses drone based thermal imaging.

When using the Inspire 1 system, we were able to extend the distance in which we could maintain live feed of the video and record the locations of multiple orangutans due to the better video transmission of the DJI Lightbridge system. This approach can be applied to larger area surveys, such as Usun Apau National Park in Sarawak, Malaysia, (Arnold, 1957; Dow et al., 2015) using video and images recorded beyond the range of the live video feed on pre-loaded autonomous flight plans. Orangutan "hot spots" can be recorded over large areas during a single night of aerial surveying and then confirmed with follow-up true colour aerial imagery or ground based surveys. Using drones with better battery life can extend the survey range and cover 1000's of hectares in a one night survey. Orthorectified imagery and digital surface models can provide accurate location and nest height above ground and in the tree canopy (+/- 2 meters).

We also detected groups of other animals in the canopy but did not descend sufficiently close to identify the species, because our focus was on orangutan. Although we were able to clearly identify them as small primates by body size and patterns of movement in the video, species identification becomes increasingly difficult with decreasing body size as also reported in other

studies (Goodenough et al., 2018; Kays et al., 2018). Once mainstream FLIR technology allows for higher resolution images as well as optical zoom capabilities, identifying small species will undoubtedly become easier.

Surveying arboreal mammals remains a difficult challenge, because evidence of presence is often confined to canopies. While arboreal surveys using camera traps have been found to be more effective in detecting arboreal mammals and birds, it remains time consuming and difficult (Bowler et al., 2017; Di Cerbo and Biancardi, 2013; Gregory et al., 2014; Olson et al., 2012). Therefore, surveying orangutans has relied primarily on ground based and aerial nest counts that can be affected by a range of uncontrollable variables and often perceived unreliable (Cheyne et al., 2013; Felton et al., 2003; Husson et al., 2009; Marshall and Meijaard, 2009; Mathewson et al., 2008; Spehar et al., 2015; Wich and Boyko, 2011). Using drones to detect chimpanzee and orangutan nests have recently been tested successfully, however, only 17% of known orangutan (*Pongo abelii*) and 8% of known chimpanzee nests (*Pan troglodytes*) were found (Bonnin et al., 2018; van Andel et al., 2015; Wich et al., 2016). There remain significant challenges with regards to selecting the optimal combination of flight speed, flying altitude and area size. Fixed winged drones can travel further distances and cover larger areas than a quadcopter drone with the same battery size. The downside is that a fixed wing must travel faster to create enough lift to stay airborne. This results in reduced nest detection rate at low altitude forcing surveyors to fly at higher altitude and then risk reducing detectability due to distance. Quadcopters can hover and descend closer to a detection to verify either a nest or an animal. However, they consume far more energy and their relative operating range is shorter than a fixed winged drone.

An important goal of our study was to develop and test a FLIR drone system platform that was cost-effective, easy to use, and within the financial means of the average conservation biologist and park manager (the price range for the two systems are between $7,500-$12,000 USD each, depending on where they are purchased). We paid $7,596.00 for all the equipment used with the P4P system and a total of $12,258.00 for the Inspire 1 system (Table 1). The system we developed and described in this study has the potential to be applied to orangutan populations across its distribution range. While we did not experience any problems with it, we recommend caution when flying model P4P, because the location and additional weight of the FLIR Pro and gimbal adds significant weight as well as slight tilt to the Phantom 4P. This puts additional strain on the four motors carrying the camera system, because its computer-controlled navigator will keep the drone pitch in a horizontal position during hovering. Whereas the P4P operates close to its maximum flying weight capacity, the DJI Inspire 1 and Zenmuse XT camera provided many advantages, especially the better range of the live feed image transmission and active recording of the GPS position into the image EXIF data. Based on our surveys, the advantages of the Inspire 1 system far outweighed the additional cost of this system. Drone and thermal imaging technology is changing very quickly these days and there will likely be better systems available for comparable prices.

We hope that our results will encourage researchers and conservationists to utilize and further develop thermal imaging systems and techniques and thereby improve the accuracy of population estimates of Asia's only great ape as well as other species of great apes known to sleep in the canopy. This will assist in current as well as future conservation intervention and management of the species.

Acknowledgements

The authors wish to extend their sincere gratitude to Copenhagen Zoo for the willingness to support the advance of conservation science and biodiversity management, especially to Bengt Holst; to United Plantations, Bhd. for permission to test and re-test system setup and checks in their plantations in Central Kalimantan, and to Muhammad Silmi for his endless willingness to provide ground-support.

Table 1. Comparison of the two thermal systems used in this study.

Detail	DJI Inspire 1 Thermal System	DJI Phantom 4 Pro Thermal System
Platform Type	Quadcopter	Quadcopter
Total weight of equipment/case	8.8 kg	7.8 kg
Carrying case dimensions	57 x 55 x 27 cm	60 x 55 x 22 cm
Standard RGB Camera	Z3 with gimbal. 1/2.3" CMOS 12.4MP	Fixed with gimbal 1" CMOS 20MP
Thermal camera sensor/lens	FLIR Zenmuse XT 640x512 9Hz	FLIR Vue Pro 640x512 9Hz
Thermal Imager	Uncooled VOx Microbolometer	Uncooled VOx Microbolometer
Sensor temperature range (high gain)	-13° to 275°F	-13° to 275°F
Digital zoom	yes (2x, 4x, 8x)	no
Gimbal	Integrated with Zenmuse XT Camera (3 axis)	Feiyu 3 axis with tilt and pan control
Controller	DJI Controller and DJI Go Software/iPad	DJI Controller and DJI Go Software/iPad
Live video	On iPad intgrated with drone control	On seperate 5" display with 900Mhz
System Requirements	iOS: 7.1 (or later)	iOS: 7.1 (or later)
Range of thermal camera live video (distance between drone and operator)	1.5-2.0 km Varies with flying altitude and local conditions (line of sight)	250-500m Varies with flying altitude and local conditions (line of sight)
Average flight time as equipped	15-17 minutes	18-21 minutes
GPS coordinates in Exif	yes	no
Simultaneous video and still images	yes	no
Approximate Cost	USD $12,500.00	USD $7,500.00

References

Amstrup, S.C., York, G., McDonald, T.L.,Nielson, R. and K. Simac (2004). Detecting denning polar bears with Forward-Looking Infrared (FLIR) Imagery. *BioScience* **54**: 337-343

Ancrenaz, M., Ambu, L., Sunjoto, I., Ahmad, E., Manokaran, K., Meijaard, E. and I. Lackman (2010). Recent surveys in the forests of Ulu Segama Malua, Sabah, Malaysia, show that orangutans (*P. p. morio*) can be maintained in slightly logged forests. *PLoS One* 5: e11510.

Ancrenaz, M., Gimenez, O., Ambu, L., Ancrenaz, K., Andau, P., Goossens, B., Payne, J., Sawang, A., Tuuga, A. and I. Lackman-Ancrenaz (2005). Aerial surveys give new estimates for orangutans in Sabah, Malaysia. *PLoS Biol* **3(1)**: e3. https://doi.org/10.1371/journal.pbio.0030003

Ancrenaz, M., Calaque, R. and I. Lackman-Ancrenaz (2004a) Orangutan nesting behaviour in disturbed forest of Sabah, Malaysia: implications for nest census. *Intl. Journ. Primatology* **25**: 983–1000.

Ancrenaz, M., Goossens, B., Gimenez, O., Sawang, A. and I. Lackman-Ancrenaz (2004b). Determination of ape distribution and population size using ground and aerial surveys: a case study with orang-utans in lower Kinabatangan, Sabah, Malaysia. *Anim. Conserv.* **7**: 375–385.

Anderson, K. and K.J. Gaston (2013). Lightweight unmanned aerial vehicles will revolutionize spatial ecology. *Front. Ecol. Environ.* **11(3)**: 138–146 doi:10.1890/120150

Arnold, G (1957). The Usun Apau Plateau. *The Geographical Journal* **123(2)**: 167-176

Bevan, E., Wibbels, T., Najera, B.M.Z., Martinez, M.A.C., Martinez, L.A.S., Martinez, F.I., Cuevas, J.M., Anderson, T., Bonka, A., Hernandez, M.H., Pena, L.J. and P.M. Burchfield (2015). Unmanned aerial vehicles (UAVs) for monitoring sea turtles in near-shore waters. *Marine Turte Newsletter* **145**: 19–22.

Bonnin, N., van Andel A.C., Kerby, J.T, Piel, A.K., Pintea, L. and S.A. Wich (2018). Assessment of chimpanzee nest detectability in drone-acquired images. *Drones* **2**: 1-17

Boonstra, R., Krebs, C.J., Boutin, S. and J.M. Eadie (1994). Finding mammals using far-infrared thermal imaging. *Journ. Mammal* **75(4)**:1063–1068

Bowler, M.T., Tobler, M.W., Endress, B.A., Gilmore, M.P and M.J. Anderson (2017). Estimating mammalian species richness and occupancy in tropical forest canopies with arboreal camera traps. *Remote Sensing in Ecology and Conservation* **3(3)**: 146–157

Chabot, D. and D.M. Bird (2010). Evaluation of an off-the-shelf unmanned aircraft system for surveying flocks of geese. *Waterbirds* **35**: 170–174.

Cheyne, S.M., Rowland, D., Höing, A. and S.J. Husson (2013). How orangutans choose where to sleep: comparison of nest-site variables. *Asian Primates Journal* **3(1)**: 13-17

Christiansen, P., Steen, K.A., Jørgensen, R.N. and H. Karstoft (2014). Automated detection and recognition of wildlife using thermal cameras. Sensors **14**: 13778–13793.

Courtois, R.A., Gingras, C., Dussault, L. and J.P. Breton-Ouellet (2003). An aerial survey technique for the forest-dwelling ecotype of woodland caribou, *Rangifer tarandus caribou. Canadian Field-Naturalist* **117**:546–554.

Croon, G.W., Mccullough, D.R., Olson, Jr C.E. and L.E. Queal (1968). Infrared scanning techniques for big game censusing. *Journal of Wildlife Management* **32**:751-759.

Di Cerbo, A.R. and C.M. Biancardi (2013). Monitoring small and arboreal mammals by camera traps: effectiveness and applications. *Acta Theriologica* **58(3)**: 279–283

Dow, R.A., Reels, G.T. and R.W.J. Ngiam (2015). Odonata collected at Usun Apau National Park, Miri Division, Sarawak, Malaysia in April and May 2012. *Journ. Int. Dragonfly Fund* **79**: 1-17.

Drever, M.C., Chabot, D., O'Hara, P.D., Thomas, J.D., Breault, A. and R.L. Millikin (2015). Evaluation of an unmanned rotorcraft to monitor wintering waterbirds and coastal habitats in British Columbia, Canada. *Journ. Unmanned Veh. Syst.* **3**: 256-267.

Dunn, W.C., Donnelly, J.P. and W.J. Krausmann (2002). Thermal infrared sensing to count elk in the south-western United States. *Wildl. Soc. Bull.* **30**: 963-967.

Dunbar, M.R. and K. MacCarthy (2006). Use of infrared thermography to detect signs of rabies infection in raccoons (*Procyon lotor*). *Journal of Zoo and Wildlife Medicine* **37**: 518–523.

Dunbar, M.R., Johnson, S.R., Rhyan, J.C. and M. McCollum (2009). Use of infrared thermography to detect thermographic changes in mule deer (*Odocoileus hemionus*) experimentally infected with foot-and-mouth disease. *Journal of Zoo and Wildlife Medicine* **40(2)**: 296–301.

Felton, A.M., Engstrom, L.M., Felton, A. and C.D. Knott (2003). Orangutan population density, forest structure and fruit availability in hand-logged and unlogged peat swamp forests in West Kalimantan, Indonesia. *Biological Conservation* **114**: 91–101.

Franke, U., Goll, B., Hohmann, U. and M. Heurich (2012). Aerial ungulate surveys with a combination of infrared and high–resolution natural colour images. *Animal Biodiversity and Conservation* **35(2)**: 285–293.

Goodenough, A. E., Carpenter, W.S., MacTavish, L., Theron, C., Delbridge, M and A.G. Hart (2018). Identification of African antelope species: Using thermographic videos to test the efficacy of real-time thermography. *African Journal of Ecology* **2018**:1-10 doi:10.1111/aje.12513.

Gonzalez, L.F., Montes, G.A., Puig, E., Johnson, S., Mengersen, K. and K.J. Gaston (2016). Unmanned aerial vehicles (UAVs) and artificial intelligence revolutionizing wildlife monitoring and conservation. *Sensors* **16(97):** doi:10.3390/s16010097

Gregory, T., Rueda, F.C., Deichmann, J., Kolowski, J. and A. Alonso (2014). Arboreal camera trapping: taking a proven method to new heights. *Methods in Ecology and Evolution* **5**: 443–451

Haschberger, P., Bundschuh, M. and V. Tank (1996). Infrared sensor for the detection and protection of wildlife. *Opt. Eng.* **35**: 882–889.

Hodgson, A., Kelly, N. and D. Peel (2013). Unmanned aerial vehicles (UAVs) for surveying marine fauna: A dugong case study. *PLoS ONE* **8(11)**: e79556. https://doi.org/10.1371/journal.pone.007955

Husson, S.J., Wich, S.A., Marshall, A.J., Dennis, R.D., Ancrenaz, M., Brassey Ret al (2009). Orangutan distribution, density, abundance and impacts of disturbance. In: Orangutans: Geographic Variation in Behavioural Ecology and Conservation, S.A. Wich, S. Suci Utami Atmoko, T. Mitra Setia and C.P. van Schaik (eds.), pp. 77-96. Oxford University Press, Oxford, UK.

Johnson, A.E., Knott, C.D., Pamungkas, B., Pasaribu, M. and A.J. Marshall (2005). A survey of the orangutan (*Pongo pygmaeus wurmbii*) population in and around Gunung Palung National Park, West Kalimantan, Indonesia based on nest counts. *Biological Conservation* **121**: 495–507.

Kays, R., Sheppard, J., Mclean, K., Welch, C., Paunescu, C., Wang, V., Kravit, G. and M. Crofoot (2018). Hot monkey, cold reality: surveying rainforest canopy mammals using drone-mounted thermal infrared sensors. *International Journal of Remote Sensing*, DOI: 10.1080/01431161.2018.1523580

Marshall, A.J. and E. Meijaard (2009). Orangutan nest surveys: the devil is in the details. *Oryx* **43**: 416–418.

Mathewson, P., Spehar, S.N., Meijaard, E., Nardiyono, Purnomo, Sasmirul, A., Sudiyanto, Oman, Sulhnudin, Jasary, Jumali and A.J. Marshall (2008). Evaluating orangutan census techniques using nest decay rates: implications for population estimates. *Ecological Applications* **18**: 208– 221.

Meijaard, E., Albar, G., Nardiyono, Rayadin, Y., Ancrenaz, M. and S. Spehar (2010). Unexpected ecological resilience in Bornean orangutans and implications for pulp and paper plantation management. *PLoS ONE* **5(9)**: e12813. doi:10.1371/journal.pone.0012813

Mulero-Pazmany, M., Stolper, R., van Essen, L. D., Negro, J. J. and T. Sassen (2014). Remotely piloted aircraft systems as a rhinoceros anti-poaching tool in Africa. *PLoS ONE* **9(1)**: e83873. doi:10.1371/journal.pone.0083873

Neufeld, H. and L. V. Vennen (2015). Aerial ungulate survey 2015), moose and white-tailed deer in Whitemud-Hotchkiss Rivers Wildlife Management Unit 527. Alberta Environment and Parks, Government of Alberta. Lower Peace Region, Peace River, Alberta.

Olson, E.R., Marsh, R.A., Bovard, B.N., Randrianarimanana, H.L.L., Ravaloharimanitra, M., Ratsimbazafy, J.H., and T. King (2012). Arboreal camera trapping for the Critically Endangered greater bamboo lemur *Prolemur simus*. *Oryx* **46(4)**: 593–597

Parker, Jr H.D. and R.S. Driscoll (1972). An experiment in deer detection by thermal scanning. *Journal of Range Management* **25(6)**: 480-481.

Payne, J. (1987). Surveying orang-utan populations by counting nests from a helicopter: A pilot survey in Sabah. *Primate Conservation* **8**: 92–103.

Russon, A.E., Erman, A. and R. Dennis (2001). The population and distribution of orangutans (*Pongo pygmaeus pygmaeus*) in and around the Danau Sentarum Wildlife Reserve, West Kalimantan, Indonesia. *Biological Conservation* **97**: 21–28.

Shahbazi, M., Theau, J. and P. Menard (2014). Recent applications of unmanned aerial imagery in natural resource management. *GIScience & Remote Sensing* **51**:339–365.

Spehar, S. N., Loken, B., Rayadin, Y. and J. A. Royle (2015). Comparing spatial capture–recapture modeling and nest count methods to estimate orangutan densities in the Wehea Forest, East Kalimantan, Indonesia. *Biological Conservation* **191**: 185-193.

Storm, D.J., Samuel, M.D., Van Deelen, T.R., Malcolm, K.D., Rolley, R.E., Frost, N.A., Bates, D.P. and B.J. Richards (2011). Comparison of visual-based helicopter and fixed-wing forward-looking infrared surveys for counting white-tailed deer *Odocoileus virginianus*. *Wildlife Biology* **17(4)**: 431-440. DOI: 10.2981/10-062

van Andel, A.C., Wich, S.A., Boesch, C., Koh, L.P., Robbins, M.M., Kelly, J., and H.S. Kuehl (2015). Locating chimpanzee nests and identifying fruiting trees with an unmanned aerial vehicle. *American Journal of Primatology* **77**:1122–1134

Vermeulen, C., Lejeune, P., Lisein, J., Sawadogo, P. and P. Bouché (2013). Unmanned aerial survey of elephants. *PLoS ONE* **8(2)**: e54700. doi:10.1371/

Wich, S., Dellatore, D., Houghton, M., Ardi, R. and L.P. Koh (2016). A preliminary assessment of using conservation drones for Sumatran orang-utan (*Pongo abelii*) distribution and density. *Journ. Unmanned Veh. Syst.* **4**: 45–52

Wich, S.A., Meijaard, E., Marshall, A.J., Husson, S., Ancrenaz, M., Lacy, R.C., van Schaik, C.P., Sugardjito, J., Simorangkir, T., Traylor-Holzer, K., Doughty, M., Supriatna, J., Dennis, R., Gumal, M., Knott, C.D and J. Singleton (2008). Distribution and conservation status of the orang-utan (*Pongo spp.*) on Borneo and Sumatra: how many remain? *Oryx* **42(3)**: 329–339.

Wich, S.A. and R.H. Boyko (2011). Which factors determine orangutan nests' detection probability along transects? *Tropical Conservation Science* **4(1)**:53-63

Wiggers, E.P. and S.F. Beckerman (1993). Use of thermal infrared sensing to survey white-tailed deer populations. *Wildlife Society Bulletin* **21**: 263–268.

Trade and conservation efforts involving the Sumatran Laughingthrush *Garrulax bicolor* in Indonesia

Chris R. Shepherd and **Lalita Gomez**

Monitor Conservation Research Society (Monitor), Box 200, Big Lake Ranch, B.C., Canada, V0L 1G0

Corresponding author: Chris R. Shepherd, *Email: chris.shepherd@mcrsociety.org*

Abstract

In 2018, the Indonesian Government provided legal protection for the Sumatran Laughingthrush *Garrulax bicolor*. This species, endemic to the island of Sumatra, is now restricted to a few submontane and montane forests on the north and south of the island. Heavily trapped for the Indonesian songbird trade, populations are in serious decline. Calls to provide full protection for this species were made close to 15 years ago, and since that time, the Sumatran Laughingthrush has become very rare and categorised as Endangered by the IUCN Red List of Threatened Species. While ex-situ conservation breeding programmes may help ensure this species does not go extinct, its continued survival in the wild will depend very much on effective law enforcement in Indonesia.

Abstrak

Pada 2018, Pemerintah Indonesia memberikan perlindungan resmi untuk burung poksay Sumatra, *Garrulax bicolor*. Burung yang merupakan spesies endemik dari Pulau Sumatra ini sekarang persebarannya terbatas pada sejumlah hutan submontana dan montana di bagian utara dan selatan Pulau. Mereka ditangkap secara besar-besaran untuk kepentingan perdagangan burung berkicau sehingga populasinya menurun tajam. Permintaan untuk memberikan perlindungan secara penuh bagi spesies ini diajukan sekitar 15 tahun yang lalu. Sejak saat itu, poksay Sumatra telah menjadi sangat jarang di alam dan dikategorikan sebagai genting pada Daftar merah IUCN bagi spesies yang terancam. Meskipun program-program konservasi untuk mengembangbiakkan spesies ini secara ex situ bisa membantu memastikan agar mereka tidak punah, kelangsungan hidup poksay Sumatra di alam liar secara berkelanjutan akan sangat bergantung pada penegakan hukum yang efektif di Indonesia.

Keywords: Laughingtrush, trade, Sumatra, Indonesia

Introduction

The Sumatran Laughingthrush *Garrulax bicolor* is endemic to the island of Sumatra, Indonesia. It is only known from a small number of sites scattered on the north and south of the island in submontane and montane forests, including secondary forests, from 750-2000m (van Marle and Voous, 1988; Collar, 2006; Eaton et al., 2016; Collar et al., 2019). Existing populations are now considered small and severely declining (Harris et al., 2015). This decline is primarily attributed to the songbird trade in Indonesia, which is fuelling the indiscriminate and persistent poaching of this species and driving it ever closer to extinction. Just as persistent however, have been efforts to raise awareness on this threat and its drastic impacts on remaining wild populations. This paper seeks to provide a documentation and time-line of events surrounding conservation efforts and trade

Submitted 15th December, 2018. Accepted 25th December, 2018

monitoring activities involving the Sumatran Laughingthrush in Indonesia from 1993-2018 and further insight on what may be required to help ensure wild populations recover from over-exploitation.

Trade and Demand

The demand for songbirds in Indonesia is massive and is pushing an increasing number of species towards extinction (Nash, 1993; Shepherd, 2004; Owen et al., 2014; Chng et al., 2015; Eaton et al., 2015; Lee et al., 2016). Among these species is the Sumatran Laughingthrush. This species is particularly vulnerable to trade as it is an island endemic, occurring in very few locations. It was formerly considered a subspecies of the White-crested Laughingthrush (*Garrulax leucolophus*) (*G. l. bicolor* – endemic to Sumatra); a more common and widespread species but was elevated to a full species in 2006 (Collar, 2006). While the change in status is a relatively recent development, bird dealers in Sumatra have always regarded the Sumatran Laughingthrush as a distinct species, calling it *Poksai Lokal*, while referring to the White-crested Laughingthrush as *Poksai Hong Kong* (Shepherd, 2007). In Jakarta, the Sumatran Laughingthrush is known as *Poksai Medan* or *Poksai Jambul Medan* (Basuni and Setiyani, 1989; Shepherd pers. obs).

Once described as common (van Marle and Voous, 1988), the Sumatran Laughingthrush has suffered a very rapid and ongoing population decline largely due to trapping for the songbird trade (Eaton et al., 2015; BirdLife International, 2016). There are no records of commercial breeding of the species, and all individuals in trade are considered to be wild-caught. This species is now considered rare, localised and locally extinct throughout its range (Shepherd, 2007; Shepherd, 2010; Shepherd, 2013; Eaton et al., 2015; BirdLife International, 2016; Eaton et al., 2016; Harris et al., 2017; Bušina et al., 2018). This is further corroborated by bird dealers who claim the species is becoming more difficult to obtain and as such market prices have soared over the years, ranging from US$ 8-15 in 2007 to US$ 90 in 2014 (Chng et al., 2014; Harris et al., 2015; Shepherd et al., 2016).

The Sumatran Laughingthrush has frequently been encountered in trade during market surveys in Java and Sumatra (Basuni and Setiyani, 1989; Nash, 1993; Shepherd, 2007; Shepherd, 2010; Shepherd, 2013; Eaton et al., 2015; Eaton et al., 2016; Bušina et al., 2018) and in online trade surveys (Iqbal, 2015). However, earlier records are incomplete, as the species was previously considered a subspecies of the White-crested Laughingthrush and no structural distinction was made between the two during survey efforts (Shepherd et al., 2004; Shepherd, 2007). White-crested Laughingthrushes were frequently observed in trade; Nash reported the species to be in the top 20 most widely traded non-CITES bird species in his studies in Indonesia between 1991 and 1993. During that study, White-crested Laughingthrushes were observed in more than 75% of the 37 surveyed shops, totalling approximately 5,400 individuals (Nash, 1993). Nash also reported observing approximately 700 birds of the race "bicolor" in seven shops during the same period (Nash, 1993). During 61 surveys carried out between 1997 and 2001 in the bird markets of Medan, 3,392 White-crested Laughingthrushes were counted and included a large but unquantified number of Sumatran Laughingthrushes (Shepherd et al, 2004; Shepherd 2006).

In addition to evidence of trade in Sumatran Laughingthrushes from market surveys carried out in the 1990s, Nash also reported on Government-set quotas for the local capture and trade of supposedly White-crested Laughingthrush (Table 1). These birds were, of course, Sumatran Laughingthrushes.

Year	Quota
1987	100
1988	100
1989	200
1990	100
1991	600
1992	0
1993	0

Table 1. According to Nash, the Indonesian Government extended quotas for harvesting wild White-crested Laughingtrushes. This contributed significantly to the population decline (Nash, 1993).

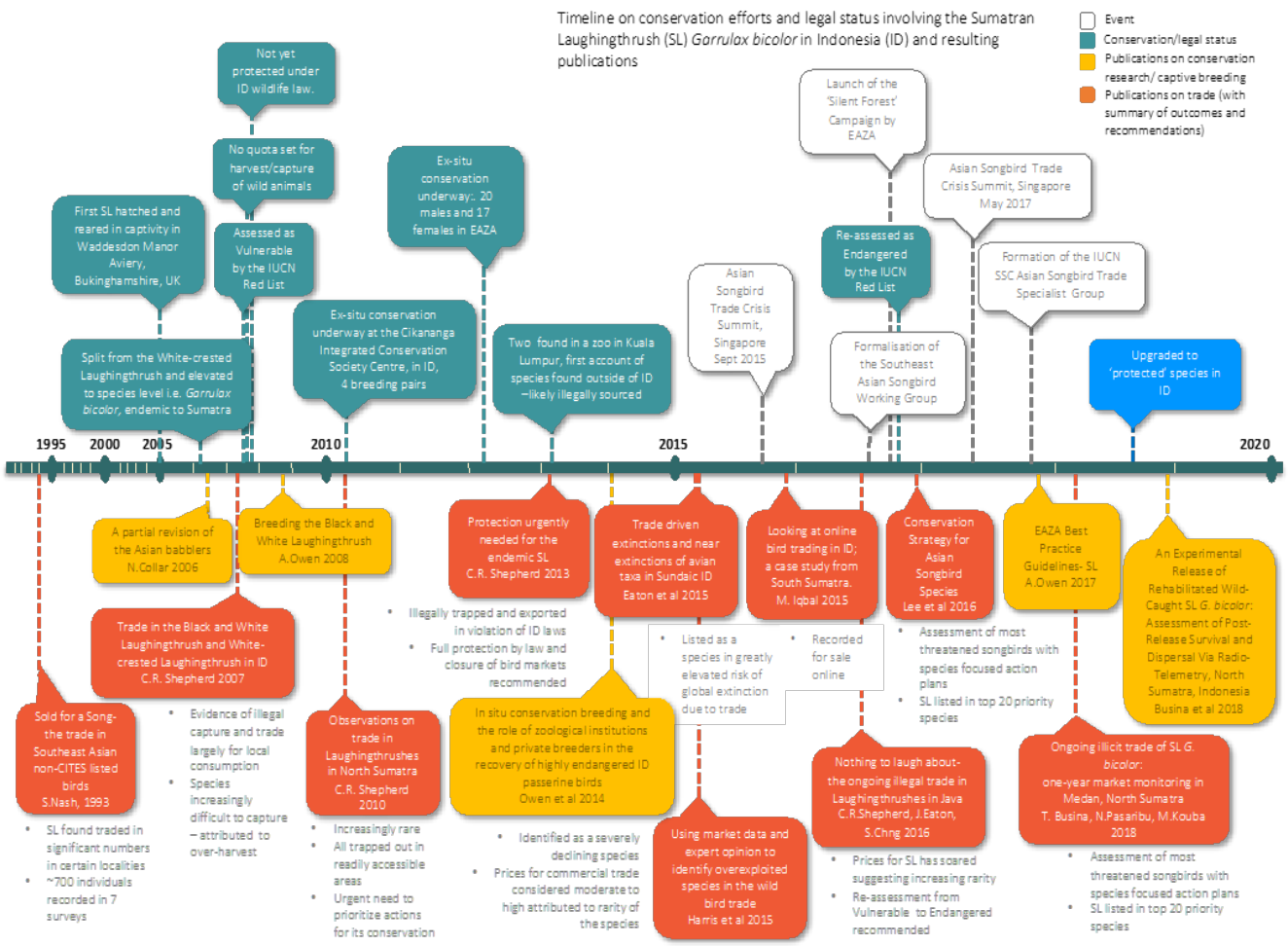


Figure 1. Time-line on conservation efforts and legal status involving the Sumatran Laughingthrush (SL) in Indonesia (ID) and resulting publications

Some authors have stated that, when the imports of the White-crested Laughingthrush to Indonesia was banned in 2005, due to the risk of avian influenza, the Sumatran Laughingthrush was targeted as its substitute (Bušina et al., 2018). However, since both species have concurrently been traded since at least the 1980s, there is little to suggest that the Sumatran Laughingthrush is merely a replacement for the White-crested Laughingthrush. To the contrary, Sumatran Laughingthrushes have likely become more common in trade following the import restrictions placed on White-crested Laughingthrush.

While most of the trade in the Sumatran Laughingthrush supplies local demand, there are anecdotal reports of the species being kept outside of Indonesia. According to Owen (2008), there was at least one importation of Sumatran Laughingthrushes into Europe around the year 2000, and by 2006, the species was known to have been in two zoological collections and in the possession of at least one private aviculturist (Owen, 2008). In March 2013, two Sumatran Laughingthrushes were observed in a zoo in Kuala Lumpur, Malaysia, and although there appear to be no export records of the species to Malaysia, this observation represents the first documented evidence of it being displayed in a South-east Asian country outside of Indonesia (Shepherd, 2013). Anecdotal information also suggests the species is currently, and increasingly, offered for sale online in Europe via private dealers.

Ex-situ conservation

The first Sumatran Laughingthrush ever reared in captivity was hatched in Waddesdon Manor Aviary,

Buckinghamshire, UK, July 2005 (Owen, 2008). Since then, conservation breeding programmes of Sumatran Laughingthrush, sometimes referred to as assurance colonies, have been in development in Indonesia at the Cikananga Integrated Conservation Society Centre, in European Association of Zoos and Aquaria (EAZA) institutions and in the hands of a few private breeders, with successful breeding taking place (Owen, 2008; Collar et al., 2012). Best practice guidelines for the breeding of this species were developed and published by the Chester Zoo, North of England Zoological Society, in 2017 (Owen, 2017).

In 2016, the Asian Songbird Trade Working Group launched the "Conservation strategy for Southeast Asian songbirds in trade (Recommendations from the first Asian Songbird Trade Crisis Summit 2015 held in Jurong Bird Park, Singapore, 27–29 September 2015)" (Lee et al., 2016). This strategy, which lists species of high priority in urgent need of conservation action, includes the Sumatran Laughingthrush. Among the actions outlined for the species is the establishment of total legal protection in Indonesia.

Subsequently, in 2017, the IUCN Asian Songbird Trade Specialist Group (ASTSG) was established to prevent the imminent extinction of songbirds threatened by unsustainable trapping and trade. The ASTSG seeks to address the impact of the songbird trade and to identify solutions, reverse songbird population declines and improve the conservation status of all species involved. The Sumatran Laughingthrush is one of the priority species for conservation attention under the auspices of the ASTSG.

In response to the crisis facing Southeast Asian songbirds, EAZA launched the "Silent Forest" campaign in 2017, which not only supports conservation breeding programmes but also campaigns to raise awareness of the plight of Asian songbird species, including the Sumatran Laughingthrush.

Call for help

Considering the impact of trade on the species, conservationists have for years persistently recommended the Indonesian Government to provide full legal protection for the Sumatran Laughingthrush under the Act of the Republic of Indonesia No. 5 of 1990 concerning Conservation of Living Resources and their Ecosystems (Undang-undang Republik Indonesia No. 5 Tahun 1990 tentang Konservasi Sumber Daya Alam Hayati dan Ekosistemnya) (Shepherd, 2007; Shepherd, 2013; Harris et al 2015; Lee et al., 2016; Shepherd et al., 2016; Busina et al., 2018), which would prohibit capture and trade of wild-caught individuals. The Sumatran Laughingthrush was afforded some level of legal protection under the Regulation of the Minister of Forestry Number 447/Kpts-II/2003, which regulates the collection and trade of all of Indonesia's unprotected species through a quota system. And since there has been no established harvest quota for the Sumatran Laughingthrush, at least not since its elevation to species level, capture or trade of wild individuals of the species is effectively illegal. Its continued presence in markets may be explained by the fact that no punishments for transgressions are stated under the law regarding trade of non-protected species, which complicates enforcement and prosecution efforts.

In July 2018, the Indonesian government launched a revised list of protected species under Government Regulation No. 7, 1999 Concerning the preservation of flora and fauna; a list which until 2018 had not been updated since it was first gazetted. On a positive note, this new list includes the Sumatran Laughingthrush as a protected species. This means that the trade and harvest of wild-caught individuals is strictly prohibited unless it involves permitted second generation captive-bred individuals. Violation of the law stipulates a five-year prison sentence and a fine of IDR100million (US$7000).

Recommendations

The government of Indonesia is applauded for its inclusion of the Sumatran Laughingthrush in the list of protected species, which is a critical step towards conservation of the species. In line with this, law enforcement capacity should be enhanced to raise awareness of the protected status of the species

and to ensure its implementation so that the illegal capture and trade of the Sumatran Laughingthrush ceases. While the new law came into force in July 2018, Sumatran Laughingthrushes were still observed in bird markets across Java in October 2018. Similarly, behaviour change among consumers, local communities and hunters/trappers involved in the poaching of songbirds - like the Sumatran Laughingthrush - should be considered and should be implemented through awareness raising campaigns and consumer education. Conservation organisations and research institutions should continue monitoring and reporting trade in the species to aid efforts to assess levels of illegal trade as well as evaluate enforcement effort and effectiveness of conservation actions in protecting the species.

Unfortunately, anecdotal information suggests there is an increasing international trade in Sumatran Laughingthrushes, but to date little solid evidence exists. Consequently, further investigation into the international trade in this species should be undertaken as a matter of priority. As the Sumatran Laughingthrush is endemic to Indonesia and is not permitted for export, listing the species in Appendix III of CITES should be considered as this would assist the Indonesian authorities in preventing illegal international trade.

While ex-situ conservation breeding programmes may help prevent the species from going extinct, its continued survival in the wild will depend critically on Indonesia's law enforcement. Inevitably, two important steps must be taken to keep the species from going extinct in the wild. Enforcing the law that protects the species, combined with stiff penalties that will effectively deter illegal capture and trade. Furthermore, increased awareness of the species' dire conservation status and the laws prohibiting capture and trade will reduce the demand in Indonesia.

Acknowledgements

We thank Boyd T. C. Leupen for helpful comments on an earlier draft of this paper. We also thank Fondation Segré for their generous support of Monitor's work on the Asian songbird trade.

References

Basuni, S. and Setiyani, G. (1989). Studi perdagangan burung di Pasar Paramuka, Jakarta dan Teknik penangkapan burung di alam (Bird trading at the Pasar Pramuka, Jakarta and the bird catching techniques). *Media Konservasi* **2**: 9-18.

BirdLife International (2016). *Garrulax bicolor*. The IUCN Red List of Threatened Species 2016: e.T22734448A95085919. http://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T22734448A95085919.en. Downloaded on 10 December 2018.

Bušina, T., Pasaribu, N. and Kouba, M. (2018). Ongoing illicit trade of Sumatran Laughingthrush *Garrulax bicolor*: one-year market monitoring in Medan, North Sumatra. *Kukila* **21**:27-34.

Bušina, T., Pasaribu, N., Hlavsa, T., Czernekova, V. and Kouba, M. (2018). An experimental release of rehabilitated wild-caught Sumatran Laughingthrush *Garrulax bicolor*: assessment of post-release survival and dispersal via radio-telemetry, North Sumatra. *Ornithol Sci* **17**:135-147.

Chng, S.C.L., Eaton, J.A., Krishnasamy, K., Shepherd, C.R. and Nijman, V. (2015). In the market for extinction: an inventory of Jakarta's bird markets. TRAFFIC Southeast Asia, Petaling Jaya, Selangor, Malaysia.

Collar, N.J. (2006). A partial revision of the Asian babblers (Timaliidae). *Forktail* **22**:85–112.

Collar, N.J., Gardner, L., Jeggo, D.F., Marcordes, B., Owen, A., Pagel, T., Pes, T., Vaidl, A., Wilkinson, R. and Wirth, R. (2012). Conservation breeding and the most threatened birds in Asia. *BirdingASIA* **18**:50-57.

Collar, N., Robson, C., de Juana, E. & Sharpe, C.J. (2019). Sumatran Laughingthrush (Garrulax bicolor). In: del Hoyo, J., Elliott, A., Sargatal, J., Christie, D.A. & de Juana, E. (eds.). Handbook of the Birds of the World Alive. Lynx Edicions, Barcelona. (retrieved from https://www.hbw.com/node/59596 on 4 January 2019).

Eaton, J.A., Shepherd, C.R., Rheindt, F.E., Harris, J.B.C., van Balen, S.B., Wilcove, D.S. and Collar, N.J. (2015). Trade-driven extinctions and near-extinctions of avian taxa in Sundaic Indonesia. *Forktail* **31**: 1–12.

Eaton, J.A., van Balen, B., Brickle, N.W. & Rheindt, F.E. (2016). Birds of the Indonesian Archipelago. Greater Sundas and Wallacea. Lynx Edicions, Barcelona.

Harris, J.B.C., Green, J.M., Prawiradilaga D.M., Giam, X., Hikmatullah, D., Putra, C.A. and Wilcove, D.S. (2015). Using market data and expert opinion to identify overexploited species in the wild bird trade. *Biological Conservation* **187**: 51-60.

Harris, J.B.C., M.W. Tingley, M.W., Hua, F., Yong, D.L., Adeney, J.M., Lee, T.M., Marthy, W., Prawiradilaga, D.M., Sekercioglu C.H. and Winarni, N. (2017). Measuring the impact of the pet trade on Indonesian birds. *Conservation Biology* **31**: 394-405.

Iqbal, M. (2015). Looking at online bird trading in Indonesia; a case study from South Sumatra. *BirdingASIA* **24**: 132-135.

Lee, J.G.H., Chng, S.C.L. and Eaton, J.A. (2016). Conservation strategy for Southeast Asian Songbirds in trade: recommendations from the first Asian Songbird Trade Crisis Summit 2015 held in Jurong Bird Park, Singapore, 27–29 September 2015. Wildlife Reserves Singapore, Singapore; TRAFFIC Southeast Asia, Selangor, Malaysia.

Nash, S.V. (1993). Sold for a song: the trade in Southeast Asian non-CITES birds. TRAFFIC International, Cambridge, UK.

Owen, A. (2008). Breeding the Black-and-white Laughingthrush *Garrulax bicolor*. A*vic. Soc*. **114(2)**: 70-79.

Owen, A. (2017). EAZA Best Practice Guidelines - Sumatran Laughingthrush *Garrulax bicolor*. North of England Zoological Society, Chester Zoo, UK.

Owen, A., Wilkinson, R. and Sözer, R. (2014). In-situ conservation breeding and the role of zoological institutions and private breeders in the recovery of highly endangered Indonesian passerine birds. *International Zoo Yearbook* DOI:10.1111/izy.12052.

Shepherd, C.R. (2006). The bird trade in Medan, North Sumatra: an overview. *BirdingASIA* **5**: 16-24.

Shepherd, C.R. (2007). Trade in the Black-and-white Laughingthrush *Garrulax bicolor* and White-crested Laughingthrush *G. leucolophus* in Indonesia. *BirdingASIA* **8**: 49-52.

Shepherd, C.R. (2010). Observations on trade in laughingthrushes (*Garrulax* spp.) in North Sumatra, Indonesia. *Bird Conservation International* **21(1)**: 86-91.

Shepherd, C.R. (2013). Protection urgently needed for the endemic Sumatran Laughingthrush. *TRAFFIC Bulletin* **25(2)**: 53-54.

Shepherd, C.R., Sukumaran, J. and Wich, S.A. (2004). Open Season: An analysis of the pet trade in Medan, Sumatra 1997-2001. TRAFFIC Southeast Asia. Petaling Jaya, Malaysia.

Shepherd, C.R., Eaton, J.A. and Chng, S.C.L. (2016). Nothing to laugh about – the ongoing illegal trade in laughingthrushes (*Garrulax* species) in the bird markets of Java, Indonesia. *Bird Conservation International*, doi:10.1017/S0959270916000320.

van Marle, J.G. and Voous, K.H. (1988). The birds of Sumatra. Tring, U.K.: *British Ornithologists' Union* (Check-list 10).

Protection from exploitation needed for the endemic Sulawesi Bear Cuscus *Ailurops ursinus* in Indonesia

Chris R. Shepherd[1], **Emerson Y. Sy**[2], **Jordi Janssen**[1] and **John Morgan**

[1]Monitor Conservation Research Society (Monitor), PO Box 200, Big Lake Ranch, B.C., V0L 1G0, Canada
[2]TRAFFIC in Southeast Asia, Petaling Jaya, Selangor, Malaysia

Corresponding author: Chris R. Shepherd, *Email: chris.shepherd@mcrsociety.org*

Abstract

Illegal trade in wildlife in Indonesia is rampant, and includes many little-known species, such as the Sulawesi Bear Cuscus *Ailurops ursinus*. Too often the trade in less charismatic species goes unnoticed, with many being pushed towards extinction. Sadly, few, if any, effective interventions are put in place to prevent further declines. The demand for the Sulawesi Bear Cuscus appears to be small but growing both nationally and internationally and increasingly, carried out on online platforms, making enforcement of existing policies difficult. Legal protection for Sulawesi Bear Cuscus in Indonesia is inadequate, obstructing effective enforcement efforts. Furthermore, the species is not listed in the Appendices of the Convention on International Trade in Endangered Species (CITES), making international control impossible. Here we examine the trade in Indonesia's bear cuscus species and make recommendations for more effective prevention of illegal trade at national and international levels.

Abtrak

Perdagangan ilegal satwa liar di Indonesia merajalela dan melibatkan banyak spesies-spesies yang kurang dikenal, seperti Kuskus Beruang Sulawesi, *Ailurops ursinus*. Seringkali, perdagangan spesies-spesies yang kurang karismatik terjadi tanpa disadari sehingga banyak yang akhirnya terdorong menuju kepunahan. Sangat disayangkan bahwa usaha campur tangan yang efektif untuk mencegah penurunan jumlah yang terus terjadi ini bisa dibilang sangat sedikit, bahkan mungkin tidak ada. Permintaan untuk Kuskus Beruang Sulawesi nampaknya masih kecil, namun mulai meningkat baik pada skala nasional maupun internasional. Selain itu, perdagangannya semakin banyak dilakukan secara daring, sehingga membuat upaya penegakan hukum yang berlaku saat ini menjadi sulit. Perlindungan hukum bagi Kuskus Beruang Sulawesi di Indonesia belum cukup. Hal ini menghalangi upaya pelaksanaan hukum yang efektif. Belum lagi, spesies ini tidak ada di dalam daftar apendiks Konvensi Perdagangan Internasional Spesies Terancam (CITES), sehingga pengawasan serta pengendalian internasional menjadi tidak mungkin dilakukan. Pada tulisan ini, kami menelaah perdagangan spesies Kuskus Beruang di Indonesia dan memberikan rekomendasi untuk pencegahan perdagangan ilegal yang lebih efektif di tingkat nasional maupun internasional.

Keywords: Bear cuscus, *Ailurops ursinus*, exploitation, illegal trade, Indonesia

Introduction

The Sulawesi Bear Cuscus *Ailurops ursinus* is endemic to Indonesia, found only on Sulawesi and surrounding islands of Butung, the Peleng Islands, the Togian Islands, and possibly Muna (Flannery, 1995; Nowak, 1999; Salas et al, 2008). It is the largest and most primitive species of the Family Phalangeridae (Dwiyahreni et al, 1999) and one of two species of this genus in Indonesia.

Submitted 6th November, 2018; Accepted January 2019.

Very little is known of the natural history of this species (Nowak, 1999) or of the conservation status. The Sulawesi Bear Cuscus is currently assessed as being Vulnerable by the IUCN Red List of Threatened Species, with threats to its survival including habitat loss, hunting by local people for food, and capture for the pet trade (Salas et al, 2008). While trade is listed as a threat, the scale and dynamics of the trade are relatively unknown. International trade is not mentioned in published literature and is not specifically mentioned as a

threat in the IUCN Red List assessment of this species (Salas et al., 2008).

Indonesia is home to at least one more Ailurops species, the Talaud Bear Cuscus *A. melanotis*, known with certainty only from one location, Salibabu Island, within the Talaud Islands, which is less than 100 km^2. (Flannery and Helgen, 2016). A bear cuscus has also been reported from Sangihe (the largest island in the Sangihe Island group), though the taxonomic identity of this species remains to be confirmed (Flannery and Helgen, 2016). The Talaud Bear Cuscus is assessed as being Critically Endangered by the IUCN Red List and is severely threatened by hunting and habitat loss (Flannery and Helgen, 2016). The Talaud Bear Cuscus is listed as a protected species in Indonesia under the Act of the Republic of Indonesia No.5 of 1990 concerning conservation of living resources and their ecosystem. There is no indication this species is being commercially bred for export.

While the Sulawesi Bear Cuscus was not specifically listed as a protected species under Indonesian legislation, the entire Phalangerid family was provided with blanket protection under Government Regulation No. 7/1999 concerning the preservation of flora and fauna. There is also a specific mention of this species being totally protected on an Indonesian government website that lists a complete version of the protected mammals of Indonesia: http://dlh.grobogan.go.id/info-lh/berita/54-daftar-satwa-langka-mamalia-indonesia-yang-dilindungi. The inclusion of the Sulawesi Bear Cuscus on the protected species list may have afforded it some level of safeguard from capture and trade; however, in August 2018, the Government of Indonesia launched a revised list of protected species (Ministerial Regulation No.92/2018), and the Sulawesi Bear Cuscus is now absent from this list, as is the blanket protection for the genus.

The hunting and trade in animals that are not protected are regulated under Regulation of the Minister of Forestry No. 447/Kpts-II/2003 concerning administration directive of harvest or capture and distribution of wild specimens. This regulation states that an annual quota is set for all animals that can be captured in the wild. Catching animals for which no quota has been set, in excess of quota that have been set, or outside provinces for which quotas have been set, is deemed illegal, even when the species concerned is not legally protected. There is no quota for the Sulawesi Bear Cuscus, however, while this theoretically provides protection from commercial exploitation, no punishments for transgressions are stated under this law and, therefore, this regulation is difficult to enforce.

Capture of breeding stock is permitted on a case-by-case basis by the Indonesian Institute of Sciences, to allow registered breeders to export live offspring as pets, but it is not known how many animals have been removed from the wild for this purpose.

As the Sulawesi Bear Cuscus and the other Ailurops species are not listed in the Appendices of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), there is no current mechanism in place to monitor, regulate or control the international trade in this species. There is also no system to record reports of international trade or incidents of illegal trade, seizures or enforcement actions relating to this species.

In addition to Indonesia having a thriving domestic illegal wildlife trade (Shepherd, 2010; Nijman et al., 2012: Eaton et al., 2015), wildlife is also frequently smuggled from Indonesia to neighbouring countries, such as the Philippines, where it is sold to meet local demand, or smuggled on to further international destinations (Shepherd, 2005; Shepherd and Sy, 2017). In the Philippines, the Wildlife Resources Conservation and Protection Act of 2001 accords protection to native and non-native wildlife. Individuals or organisations are required to obtain relevant permits from the Department of Environment and Natural Resources (DENR) to collect, import/export, possess, trade, and transport wildlife. Wildlife without permits can be seized in favour of the State.

Recently, there have been anecdotal reports of

Sulawesi Bear Cuscus being harvested live from the wild for the international pet trade, yet little is known of this trade, the legality of it or the potential impact on wild populations. As such, this paper intends to shed light on the trade in this species, to call for transparency in the trade of this species and open the door for further potential research, national and international regulation and conservation initiatives.

Methods

In July 2018, a rapid online trade survey was carried out to identify and compile incidences of trade in Sulawesi Bear Cuscus from 2012-2018. The survey was made across 45 different Indonesian wildlife trade Facebook groups. Searches were conducted using the key words "kuskus beruang" (bear cuscus) in the Facebook search bar with the tab "Your Groups" selected under the filter options. The number of members in groups ranged from 324 – 148,816. When an advertisement was identified to be selling a Sulawesi Bear Cuscus, information was collected on the location, price, and the number and size of individuals advertised. No personal data about the sellers were collected and no interaction with sellers took place.

A letter requesting information regarding legal trade, captive breeding and export of Sulawesi Bear Cuscus was sent 30 August 2018 to the Head of Section of Wildlife Traffic Control, the Head of Section of Captive Breeding and the Deputy Director of Species Utilization in the Indonesian Government. Further information on the trade in this species in Indonesia was obtained from wildlife trade researchers, as well as published and unpublished literature.

In the Philippines, a survey was conducted in 30 Facebook groups engaged in wildlife trade in the Philippines in July 2018 to monitor the availability of this species in the online platform. Facebook is known to be a major venue of illegal wildlife trade in the Philippines (Sy, 2018).

Further information on the trade in this species was obtained in the Philippines by reviewing data from seizure records of the Biodiversity Management Bureau-DENR (BMB-DENR), DENR region 12, newspaper articles, and from wildlife researchers.

As one of the few countries that record imports of non-CITES species, import and export data for the United States of America (USA) was also checked, and was obtained from the US Fish and Wildlife Service (USFWS) Law Enforcement Management Information System (LEMIS) covering the period 2000-2014. LEMIS specifies the content of each shipment with either a species code, a genus code or a more general code (e.g. NONR= Non-CITES reptile), with the latter more common in larger shipments (Schlaepfer et al., 2005). Here, we searched for data specifically labelled as *Aliurops ursinus*.

Observations

Illegal wildlife trade within online trade and hobbyist groups is rampant. A survey of Facebook groups between 2012 and 2018 yielded a total of 31 unique advertisements (Figure 1) selling Sulawesi Bear Cuscus, with a total of 44 individuals offered for sale. Number of advertisements found annually from 2012 to 2017 remained stable until a sharp rise in the number of advertisements was observed in 2018. Of these, 21 advertisements contained just one animal and 10 included more than one individual (ranging from 2 – 5). Fifteen different Facebook groups had advertisements selling Sulawesi bear cuscus, of which one was a secret group, 10 were closed groups and 4 were public groups. Within these groups, 25 different traders were identified to be selling Sulawesi Bear Cuscus, and of these, six traders posted more than one advertisement. The prices ranged from IDR 1,200,000 (USD 70.00) to 3,500,000 (USD 230) for one Bear Cuscus individual (n = 6). Traders stated that the preferred method of payment was via REKBER (rekening bersama – transfer via a third-party joint account) (n = 18) followed by cash on delivery (n = 2). The majority of traders were located in East Java (13), followed by Jakarta (4), Sulawesi (2), West Java (1) and Central Java (1).

In November 2017, a man was arrested in South Sulawesi for attempting to sell three Sulawesi Bear

Table 1. Numbers of adverts selling Sulawesi Bear Cuscus per year (2012-2018).

2012	2013	2014	2015	2016	2017	2018
1	2	3	2	3	3	17

Cuscus online, along with a variety of other species of birds and mammals from Sulawesi (http://news.metrotvnews.com/read/2017/12/20/804811/polda-sulsel-tangkap-residivis-pedagang-satwa-dilindungi).

There is anecdotal information that at least one wildlife breeder in Jakarta has been granted permission to obtain wild-caught parent stock to attempt to breed Sulawesi Bear Cuscus for commercial sale. However, details about this were not publicly available and there have been no responses to inquiries sent to the relevant government authorities in Indonesia. Sulawesi Bear Cuscus are not listed in the Indonesian Government's annual harvest and quota list for 2018, but special permission may have been granted.

Illegal trade in wildlife smuggled out of Indonesia to the Philippines is common. On 7 August 2012, 17 Sulawesi Bear Cuscuses were seized in Barangay Calumpang, General Santos City, South Cotabato Province, Mindanao Island, the Philippines. Five suspects, including one Indonesian and four Filipino nationals, were arrested by the Maritime Group of the Philippine National Police and DENR. The Sulawesi Bear Cuscuses were most likely destined to privately-owned zoological parks that are in constant search for novel and unusual animals to exhibit. South Cotabato Province has been implicated as a key entry point utilised by traffickers for smuggled Indonesian wildlife.

The authors did not observe Sulawesi Bear Cuscus for sale online in the Philippines, but this may be due to trafficker's preference to deal directly with private collectors.

LEMIS

The USA LEMIS database reports the import of 151 Sulawesi Bear Cuscus and the export of two specimens. The majority of the transactions are described as Garment (GAR) and Hair (HAI) or other products and are exported by, or originate from, New Zealand. The attached generic name "Possum" suggests that these transactions are mistakenly documented as *Aliurops ursinus* but are actually Common Brushtail Possums *Trichosurus vulpecula*. The latter is a widespread agricultural invasive species in New Zealand, introduced for the fur industry.

Fourteen specimens are documented to originate from Indonesia, of which 10 are also documented as Possum and declared as Garment. The remaining four animals, of which two are documented as *A.u.togianus*, are documented as Specimen (Scientific or Museum). These four specimens were imported from Australia with Indonesia listed as its origin. Two out of four were imported for scientific purposes, the remaining two were exported with an unknown purpose code (N). The data available in the LEMIS database suggest that the majority of documented trade consists of misidentified animals and do not consists of Sulawesi Bear Cuscus. The remaining transactions, while they do originate from Indonesia, likely consists of scientific specimens and not live animals. There does not appear to have been any documented import of live Sulawesi Bear Cuscus in the USA.

Discussion and recommendations

Considering the demand for wildlife as pets and given the ease in finding this species for sale on online platforms, illegal trade of Sulawesi Bear Cuscus is likely common in Indonesia, especially in the main cities on Java. Surveys carried out in Facebook wildlife trade groups found a total of 31 unique advertisements that rose from one to 17 per year in the period from 2012 to 2018. A total of 44 individual Sulawesi Bear Cusus were observed for sale in these sites, some of which were open or public groups. The spike in trade observed in 2018 could be due to an increase of animals in trade or highlight a general shift from physical market to online trade (Chng and Bouhuys, 2015; Bergin et al., 2017). Nevertheless, while there has been some enforcement action targeting online traders, it has clearly not been enough to deter the trade, in view that the online trade seems to be increasing.

Online trade is more difficult to police than physical markets as traders can set up anonymous accounts or use fake names when making a transaction (Krishnasamy and Stoner, 2016; Morgan and Chng, 2017). This has been complicated further with an increase in use of the REKBER transfer system, which was the preferred method of payment observed in this survey. In the REKBER system, a third-party bank account is used so that no recordable transaction takes place between the trader and the buyer, making it difficult for police to link the two criminals or prove any illegal activity took place.

The online trade in Sulawesi Bear Cuscus appeared to be limited to the Islands of Sulawesi and Java, with the province of East Java having the highest incidences of trade. In East Java, the capital city Surabaya is a known destination and transit point for smuggled wildlife from Kalimantan, the Moluccas, Papua and Sulawesi (Chng and Eaton, 2016). The larger numbers of traders recorded in East Java therefore may indicate that this existing trade route is also being used to smuggle Bear Cuscus from Sulawesi into Java.

Enforcement efforts to prevent illegal hunting and trade in bear cuscus species in Indonesia is weak (Flannery and Helgen, 2016) and it is highly likely that enforcement officers globally do not have the skills to identify the species, especially as international trade appears to be rather sporadic, and as the species is not listed in the appendices of CITES. We encourage the Government of Indonesia, as the only range country, to place the genus Ailurops in Appendix III of CITES, or to propose it be listed in Appendix II, to gain the international community's assistance in preventing illegal international trade of Sulawesi Bear Cuscus. CITES member countries would be obligated to seize specimens of this species in trade without the required permits. Listing the species in CITES would also provide a mechanism for monitoring and recording of trade.

As this species has been seized in the Philippines, it is clear that some illegal international trade in Sulawesi Bear Cuscus persists as well. The Philippine wildlife authorities will continue to seize wildlife without proper permits as and when detected; however, the scale of the undetected trade is not known, nor is the demand in countries beyond the Philippines for this species. Furthermore, illegal trade to other countries with high demand for wildlife from Indonesia has yet to be investigated, although no such commercial trade to the USA appeared in a search of LEMIS data. We encourage individuals and/or organisations monitoring trade in wildlife to publicise seizures or other information pertaining to the trade in Ailurops species to further assist in understanding the impact of trade on these species and to assist in the planning and implementation of appropriate conservation interventions.

The recent revision of the list of species protected under the Government Regulation No.7, 1999, Concerning the preservation of flora and fauna omits the Sulawesi Bear Cuscus, leaving this species vulnerable to exploitation. We encourage the Government of Indonesia to list the Sulawesi Bear Cuscus as a protected species under the Government Regulation No.7, 1999, Concerning the preservation of flora and fauna, especially since the zero-quota status of the species is in itself difficult to enforce.

Anecdotal information suggests that permission has recently been given to at least one commercial breeder of wildlife in Indonesia to harvest specimens from the wild for use as breeding stock to supply offspring for the pet trade. Indonesia requires that species bred in captivity for commercial sale are second generation (F2) production, and it is highly unlikely that any second-generation stock exist, given permission to breed this species has apparently only been granted recently. The Government of Indonesia is encouraged to make this information publicly available, to assist authorities in other countries, as well as conservation organisations, better determine the legality of specimens in trade. Finally, we ask that the IUCN Red List authorities for the Sulawesi Bear Cuscus recognise commercial trade at national and international levels as a potential risk to the survival of the species in the IUCN Red List assessment, and thus encourage researchers, enforcement agencies and policy makers to include the threat of trade in future conservation and regulatory interventions.

Acknowledgements

The authors are grateful to Mundita Lim and Ali Hadjinasser for providing relevant information with regards to the Philippines. In Indonesia, we thank Karlina Indraswari for providing valuable information. An anonymous donor is thanked for supporting Monitor's work on this publication. The authors are grateful to Lalita Gomez for very helpful comments on an earlier draft of this note. Biofagri Rachmayuningtyas is thanked for assistance with translation.

References

Bergin, D., Atoussi, S. and Waters, S. (2017). Online trade of Barbary macaques *Macaca sylvanus* in Algeria and Morocco. *Biodiversity and conservation* **27(2)**: 531-534.

Chng, S. and Bouhuys, J. (2015). Indian star tortoises: shop sales fall as internet trade increases. *TRAFFIC Bulletin* **27(2)**: 73-78.

Chng, S. C., and Eaton, J. A. (2016). In the market for extinction: eastern and central Java. TRAFFIC Southeast Asia.

Direktorat Konservasi Sumber Daya Alam dan Ekosistem (2018). Kuota pengambilan tumbuhan alam dan penangkapan satwa liar, periode tahun 2018. Direktorat Konservasi Keanekaragaman Hayati, Jakarta, Indonesia.

Dwiyahreni, A. A., Kinnaird, M. F., O'Brien, T. G., Supratna, J and Andayani, N. (1999). Diet and Activity of the Bear Cuscus, *Ailurops ursinus*, in North Sulawesi, Indonesia. *Journal of Mammalogy* **80(3)**: 905-912.

Eaton, J. A., Shepherd, C. R., Rheindt, F. E., Harris, J. B. C., van Balen, S. (B.), Wilcove, D. S. and Collar, N. J. (2015). Trade-driven extinctions and near-extinctions of avian taxa in Sundaic Indonesia. *Forktail* **31**: 1–12.

Flannery, T. F. (1995). Mammals of the South-West Pacific and Moluccan Islands. Comstock/Cornell, Ithaca, NY, USA.

Flannery, T. and Helgen, K. (2016). *Ailurops melanotis*. The IUCN Red List of Threatened Species 2016: e.T136218A21949526. http://dx.doi.org/10.2305/IUCN.UK.2016-2.RLTS.T136218A21949526.en. Downloaded on 19 June 2018.

Krishnasamy, K. and Stoner, S. (2016). Trading faces: a rapid assessment on the use of Facebook to trade wildlife in Peninsular Malaysia. TRAFFIC Report. Petaling Jaya, Selangor, Malaysia.

Morgan, J. and Chng, S. (2017). Rising internet-based trade in the Critically Endangered ploughshare tortoise *Astrochelys yniphora* in Indonesia highlights need for improved enforcement of CITES. *Oryx* **52(4)**: 744-750.

Nijman, V., Shepherd, C. R., Mumpuni and Sanders, K. L. (2012). Over-exploitation and illegal trade of reptiles in Indonesia. *Herpetological Journal* **22**: 83-89.

Nowak, R. M. (1999). Walker's Mammals of the World (5th edition). John Hopkins University Press, Baltimore, Maryland, USA.

Salas, L., Dickman, C., Helgen, K. and Flannery, T. (2008). *Ailurops ursinus*. The IUCN Red List of Threatened Species 2008: e.T40637A10346312. http://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T40637A10346312.en. Downloaded on 18 June 2018.

Shepherd, C. R. (2005). Indonesia and the Philippines meet to curb trade in parrots. *TRAFFIC Bulletin* **20(2)**: 54.

Shepherd, C. R. (2010). Illegal primate trade in Indonesia exemplified by surveys carried out over a decade in North Sumatra. *Endangered Species Research* **11**:201-205.

Shepherd, C. R. and Sy, E. Y. (2017). First record of international trafficking of Critically Endangered long-beaked echidnas (*Zaglossus* sp.). *Journal of Indonesian Natural History* **5(1/2)**: 22-26.

Sy, E.Y. (2018). Trading Faces: Utilisation of Facebook to trade live reptiles in the Philippines. TRAFFIC, Petaling Jaya, Selangor, Malaysia.

Trade in Tokay geckos for medicine on Java

Vincent Nijman[1], **Muhammad Ali Imron**[2] and **K.A.I. Nekaris**[1]

[1]Oxford Wildlife Trade Research Group, Oxford Brookes University, Oxford OX3 0BP, UK
[2]Faculty of Forestry, Universitas Gadja Mada, Yogyakarta, Indonesia.

Corresponding author: Vincent Nijman, *E-mail: vnijman@brookes.ac.uk*

Introduction

Tokay geckos, *Gekko gecko*, are widely distributed in Southeast Asia and are traded in significant quantities throughout Asia. For instance, between 2004-2013 Taiwan PoC imported ~15 million geckos from Thailand and Indonesia (Caillabet, 2013). Trade is largely in the form of dried individuals, to be used in traditional Asian medicine. Purportedly, medicines made out of Tokay are effective in treating a wide range of ailments from diabetes and erectile dysfunction to suppressing asthma and relieving coughing (Gu et al., 2011; Bauer, 2009). From 2009-2011, it was believed that unusually large Tokays could be used as a cure for HIV/AIDS (Caillabet, 2013). A small number of Tokays are traded internationally for the pet trade (Nijman et al., 2012). It seems that the two countries that supply the majority of both the medicinal and live pet trade are Thailand and Indonesia (Caillabet, 2013).

Tokays are not protected in Indonesia, but there is a harvest quota in place whereby only a limited amount of geckos can be taken from the wild. These quotas are set in consultation with the Indonesian Institute of Sciences (also acting as Indonesian CITES Scientific Authority) and, presumably on basis on field surveys, these quotas have been reduced by 50% over the last decade. For 2018, the quota stood at 25,250 animals, specifically for the live pet trade, with 90% of these intended for export and only 2,525 allowed for the domestic market. Two-thirds of the harvest quota was allocated to Java (17,000/25,250) and the remainder to ten provinces in Sumatra, Borneo and Sulawesi. While private citizens are permitted to catch, keep and use Tokays, harvesting for the purpose of commercial trade is regulated by the set quotas.

A number of studies have been conducted on the trade of Tokays for medicinal purposes in Java, but most of them focussed on export. Kartikasari et al. (2008), on the basis of interviews with harvesters, collectors and sellers distributed throughout Central Java, estimated that 975,000 Tokays were harvested each year from this province alone. Data from the Central Javan commerce board indicated that the dried geckos were exported to Hong Kong (Kartikasari et al., 2008). Nijman et al. (2012) and Nijman and Shepherd (2015) showed that between one and three million of wild-caught dried Tokays were exported from Central and East Java annually, with the main export destinations China and Hong Kong SAR. With regards to the export of non-protected species, these exports are in clear violation of Indonesia's quota system and regulations.

Little is known about the scale of the trade in Tokays in Indonesia for domestic consumption. Legally, only a small amount of wild-caught Tokays can be traded commercially, but the actual trade volume may be substantially higher than anticipated. We here report on the domestic trade of Tokay Geckos in the wildlife markets of Java and Bali.

Methods and Results

There are at least 53 bird or animal markets, locally known as *pasar buring* and *pasar satwa* on Java

Submitted 4th October, 2018. Accepted 20th November, 2018

Table 1. Tokay gecko trade in wildlife markets in Java and Bali, Indonesia, from 2012 - 2018. High = multiple visits in four or more years; Medium = multiple visits in one year but not in others, or single visits four or more years; Low = single visits in three or less years.

Location	Animal market	Market size	Survey effort*	# Tokay-/visit
DKI Jakarta	Jakarta, Pramuka	large	high	80
DKI Jakarta	Jakarta, Jatinegara	large	high	40
DKI Jakarta	Jakarta, Barito	medium	high	10
West Java	Bogor, T Empang	medium	medium	5
West Java	Bogor, Pasar Bogor	small	medium	0
West Java	Bandung, Sukahaji	large	high	20
West Java	Garut, Mawar	small	high	0
West Java	Garut, Kerkhof	small	high	20
West Java	Cirebon, Plered	medium	medium	40
West Java	Tasikmalaya, Cikurubuk	medium	medium	0
West Java	Ciamis, Manis	medium	low	0
Central Java	Surakarta, Depok	large	low	50
DI Yogyakarta	Yogyakarta, Pasty	large	low	120
East Java	Surabaya, Bratang	large	medium	70
East Java	Surabaya, Turi	medium	medium	10
East Java	Surabaya, Kupang	large	medium	170
East Java	Malang, Senggol	large	low	20
East Java	Situbondo	medium	low	30
East Java	Bondowoso	small	low	10
East Java	Banyuwangi, Pujasera	small	low	0
Bali	Denpasar, Satria	medium	high	20
Bali	Mengwi, Beringkit	small	medium	0

and Bali, where a wide range of wild-caught birds and mammals are sold (Nijman et al., 2018). Many of these markets also have one or more stalls offering Tokays for sale. Whereas most of these are alive in the markets, they are primarily sold for medicinal purposes, with the animals killed on the spot when purchased. Tokays then can be roasted, fried or baked and consumed to relieve itchiness of the skin, eczema, shortness of breath or asthma, and their products can be used as an aphrodisiac (Arisnagara, 2009; Zayadi et al., 2016).

From 2012 to 2018, we made numerous recurrent visits to eight large animals markets (<50 shops or stalls), eight medium markets (= 20-49 shops or stalls) and six small markets (>20 shops or stalls). For each market, we estimated the number of live Tokays for sale and averaged this for different market size categories. While survey intensity differed between markets, we did not find any bias to the number of Tokays in markets that were surveyed more frequently. In markets with high survey intensity we found an average 27 Tokays (range 0-80), 37 (range 0-170) for markets with medium survey intensity and 33 (range 0-50) in markets, with low survey intensity. On average, large markets offered more Tokays for sale (71, range 20 to 170) than medium markets (14, range 0 to 40) and small markets (5, range 0 to 20). Extrapolation to all 53 animal markets and adjusting for market size, an average 1,048 Tokays are offered for sale daily. We found an average of 715 in the animal markets that we monitored.

Figure 1. Workers from CV Andira Alternatif in Probolinggo, East Java, preparing dried Tokay Geckos for export (Fahmi 2017).

Traders purchase Tokays for ~US$0.20 and sell them for ~US$0.80 each. The cost of keeping Tokays in the markets is negligible, suggesting that this trade is lucrative and turnover is high. Assuming a one-week turnover time, approximately 55,000 Tokays are traded in a year. With the combined human population on Java and Bali numbering 155 million, only one in every 3,000 people has to consume one Tokay per year to create a demand for 55.000 Tokays.

The majority of people living on Java are Muslim and, while it is generally agreed that consumption of Tokays is considered *haram* (prohibited according to Islamic law), scholars have discussed if the use of geckos as medicine is permissible (Zayadi et al., 2016; Halimah, 2013). While this debate is ongoing, consumers on Java of all religious denominations continue to use Tokays for medicinal purposes.

Bogus captive breeding

In 2014, four of the largest dried Tokays export companies CV Karya Abadi Reptil Mulia and UD Karya Reptil Sentosa in Sitoarjo (East Java), PT Manta Pratama Unggul Perkasa (Semarang, Central Java) and CV Andira Alternatif (Probolinggo, East Java) were granted permission to breed 2,980,000 Tokays for live export for the pet trade --- that is, this permit did not allow breeding for the production of Tokays for medicinal purposes (Fig.1). These quotas were slightly lowered to 2,855,000 in 2016 (Anonymous 2016). These figures are above the quota that is set for wild-caught Tokay Geckos; if indeed these three million geckos were bred in a closed environment this should have a minimal impact on the wild population. It is however highly unlikely that any captive breeding takes place.

The four companies granted breeding permits are all reptile skins and meat exporters with little recorded trading of live animals for the pet trade. As of 2018, all four companies are still registered as meat and reptile skin exporters in the Indonesian Directory of Exporters (Fig.2). Three of the four companies only have made requests to the Indonesian authorities to breed Tokays, but no other reptiles. CV Karya Abadi Reptil Mulia, however, has permission to breed a range of snakes for the international pet market, e.g. 125,000 Oriental Rat Snakes, *Ptyas mucosa*, 30,000 Masked Water Snakes, *Homalopsis buccata* and 25,000 Javan File Snakes *Acrochordus javanicus*. All these species are widely traded for meat and skins and it is highly likely that these are not exported as live pets.

The logistics of breeding millions of Tokays is considerable and the profit made from export is not able to cover the cost of production. If the quantities reported in trade are accurate, it is clear that this can only be sustained through the routine laundering of wild-caught individuals and their export as dead specimens, rather than live for the pet trade.

Recommendations for improvement of trade

There is an urgent need to address the illegal trade in Tokay Geckos on Java. In the present regulatory framework the Indonesian Ministry of Forestry and Environment, through their Regional Branches, should enforce current quotas and shut down companies that export dried Tokays. If it is broad consensus that export of dried Tokays for the TAM trade should also be allowed permitted, the rules need to be amended.

Domestic trade in Tokay Geckos, either for pets or for medicine, is generally not taken into account when setting harvest quotas or levels of domestic trade as set at unrealistically low levels (i.e. 10%

Figure 2. 2018 profile of CV Andira Alternatif in the Directory of Exporters from the Ministry of Industry in Indonesia showing its listing as an exporter of reptile meat. Similar entries are available for CV Karya Abadi Reptil Mulia, UD Karya Reptil Sentosa and PT Manta Pratama Unggul Perkasa.

of the total). Actual trade quantities are 20 times higher than permitted and this should either be reflected in a) the quota setting, or b) current quotas need to be enforced, thus shutting down the open Tokay trade in the animal markets.

Captive breeding quotas should only be given to facilities that do indeed breed the species for which permission is given. Bogus captive "breeding facilities" and large-scale laundering of wild-caught individuals as captive bred stockpiles jeopardizes consumer and importer trust and undermines the regulatory system. As a matter of urgency, facilities that claim to breed a million Tokays a year should be investigated and held accountable of any fraud. There is sufficient evidence that there is a need for better regulation of the Tokay and other wildlife trade. The listing in CITES Appendix II is appropriate and provides the necessary framework to achieve this for the international trade. Tokays qualify under Annex 2(a), Criteria B of Resolution Conf. 9.24, and it would be prudent of China and Indonesia, in line with its current domestic regulations, to fully support such a proposal.

References

Anonymous (2011) Digagalkan, ekspor tokek kering. SerambiNews.com. 7 November 2011.

Anonymous (2016). Rencana produksi reptile, amphibi dan mamalia (RAM) pet hasil penangkaran tahun 2016. PHKA, Jakarta.

Arisnagara, F. (2009). Pemanfaatan reptile sebagai obat dan makanan di Daerah Ibu Kota (DKI) Jakarta. BSc thesis, Bogor Agricultural University, Bogor.

Bauer, A. (2009). Geckos in traditional medicine: forensic implications. *Applied Herpetology* 6: 81–96.

Caillabet, O. (2013). The trade in Tokay Geckos in South-East Asia: with a case study on Novel Medicinal Claims in Peninsular Malaysia. TRAFFIC Southeast Asia, Petaling Jaya.

Fahmi, M. (2017). Baru 11 perusahaan mampu ekspor sendiri, tokek kering Leces termasuk. *Radar Bromo* 17 October 2017.

Gu, H.F., Xia, Y., Penga, R., Mo, B.H., Li, L. and Zenga, X.M. (2011). Authentication of Chinese crude drug gecko by DNA barcoding. *Natural Product Communications* **6**: 67-71.

Kartikasari, D., Masy'ud, B., and Kusrini, M.D. (2008). Animal utilization as traditional medicine in Central Java. Pp 232-233 in Proceedings of Asian Zoo /Wildlife Medicine and Conservation. Bogor Agricultural University, Bogor

Nijman, V., Shepherd, C.R., Mumpuni and K.L. Saunders (2012). Over-exploitation and illegal trade of reptiles in Indonesia. *Herpetological Journal* **22**:83–89.

Nijman, V and Shepherd, C.R (2015). Adding up the numbers: an investigation into commercial breeding of Tokay geckos in Indonesia. TRAFFIC. Petaling Jaya, Malaysia.

Nur Halimah, S. (2013). Tinjauan hukum Islam terhadap praktek jual beli Tokek untuk obat-obatan (Studi kasus di desa Tajung Sari Kecamatan Tlogowungu Kabupaten Pati). PhD dissertation, Universitas Islam Negeri Walisongo, Semarang.

Zayadi, H., Azrianingsih, R. and Sjakoer, N.A.A. (2016). Pemanfaatan hewan sebagai obat-obatan berdasarkan persepsi masyarakat di kelurahan Dinoyo Malang. *Jurnal Kesehatan Islam* **4**: 1-5.

Observations of trade in Spotted Crocias *Laniellus albonotatus* in Java, Indonesia

Boyd T.C. Leupen[1] and **Chris R. Shepherd**[1]

[1] Monitor Conservation Research Society (Monitor), Box 200, Big Lake Ranch, B.C., V0L 1G0, Canada

Corresponding author: Boyd T.C. Leupen, *Email: boyd.leupen@mcrsociety.org*

Introduction

The Spotted Crocias *Laniellus albonotatus* is endemic to the island of Java, Indonesia, where it is restricted to a few remaining broadleaved montane forests (900-2,400m) in West Java Province (BirdLife International, 2017). The species is currently classified as Near Threatened on the IUCN Red List of Threatened Species. Although thorough assessments have not been made, Spotted Crocias populations are thought to be in decline due to habitat loss, and trapping for trade has been suspected to play a role as well (BirdLife International, 2017). The species' Red List entry suggests that trade monitoring efforts are needed to establish a comprehensive understanding of the species' presence in Indonesian markets.

Here we report on five Spotted Crocias trade observations made during market surveys in Java, conducted between the 2nd and 15th October 2018. The first observation occurred on the 7th October during a visit to Yogyakarta's Pasar Satwa dan Tanaman Hias market and involved a single individual (Fig. 1). The other observations were made on the 13th October during a visit to Jakarta's Pramuka bird market. Here, four Spotted Crocias were found across an equal number of stalls. No price data were collected during these visits. As part of the survey, twelve more markets were visited across five other Javan cities (Bandung, Bogor, Malang, Semarang and Surabaya), but no additional Spotted Crocias were found.

We searched published market surveys between 2006 and 2018 for other Spotted Crocias trade observations in Indonesia and found a total of eight; during a survey of Jakarta's three main bird markets (Barito, Jatinegara and Pramuka) between the 21st and 23rd of July 2014, seven birds were found across four stalls (Chng et al., 2015). On the 4th September 2016, one individual was found for sale on the Sukahaji market in Bandung (Chng et al., 2016).

These observations show that Spotted Crocias are traded and confirm suspicions regarding the trapping of these birds. Online videos of caged Spotted Crocias, posted by hobbyists, confirm that the species is kept for its singing abilities (https://www.youtube.com/watch?v=g3Mbd1f9JuE). Current demand for the species does not appear to be high, as reflected by the low number of trade observations. However,

Figure 1. Spotted Crocias *Laniellus albonotatus* observed on the 7th October 2018 in Pasar Satwa dan Tanaman Hias in Yogyakarta. (Photograph: Monitor)

Late submission accepted March, 2019

while montane species such as the Spotted Crocias were previously absent from markets, they are now increasingly observed. It is likely that the increasing scarcity of lowland species, resulting from habitat loss and over-exploitation, is causing trapping efforts to shift towards these montane birds (Chng and Eaton, 2016; Chng et al., 2015). As Spotted Crocias habitats continue to disappear, increasing exposure will render the species even more vulnerable to shifting trade trends.

The Spotted Crocias is protected under Indonesian law, making all observed trade strictly illegal. The illicit and unsustainable songbird trade in Indonesia is rampant and poses a threat to many species. In Java, the keeping of songbirds remains deeply entrenched in society (Bergin et al., 2018; Jepson and Ladle, 2005, 2009; Jepson et al., 2011), sustaining a demand that is driving a growing number of species towards extinction (Bergin et al., 2018; Eaton et al., 2015; Shepherd et al., 2015). All too often, conservation actions are taken too late.

Systematic trade monitoring is necessary to detect trade trends, including potential trade increases in lesser-known species such as the Spotted Crocias. The species' limited distribution and endemicity are likely to increase its vulnerability to over-exploitation and warrant extra vigilance. As proposed in its Red List entry, steps should be taken to assess further the potential threats to this species and implement appropriate conservation interventions.

Acknowledgements

We would like to thank Fondation Segré for their generous support of Monitor's songbird work. We also thank James Eaton and Richard Thomas for their helpful comments on an earlier draft of this paper.

References

Bergin, D., Chng, S., Eaton, J. and C. R. Shepherd (2018). The final straw? An overview of Straw-headed Bulbul *Pycnonotus zeylanicus* trade in Indonesia. *Bird Conservation International* **28(1)**: 126–132.

BirdLife International (2017). *Laniellus albonotatus* (amended version of 2016 assessment). The IUCN Red List of Threatened Species 2017: e.T22716693A110968776. http://dx.doi.org/10.2305/IUCN.UK.2017-1.RLTS.T22716693A110968776.en. [Accessed on 31 October 2018].

Chng, S. C. L and J. A. Eaton (2016). In the market for extinction: Eastern and Central Java. TRAFFIC Southeast Asia, Petaling Jaya, Selangor, Malaysia.

Chng, S. C. L., Eaton, J. A., Krishnasamy, K., Shepherd, C.R. and V. Nijman (2015). In the market for extinction: an inventory of Jakarta's bird markets. TRAFFIC Southeast Asia, Petaling Jaya, Selangor, Malaysia.

Chng, S. C. L., Guciano, M. and J. A. Eaton (2016). In the market for extinction: Sukahaji, Bandung, Java, Indonesia. *BirdingAsia* **26**: 22–28.

Eaton, J. A., Shepherd, C. R., Rheindt, F. E., Harris, J. B. C., van Balen, S. (B.), Wilcove, D. S. and N. J. Collar (2015). Trade-driven extinctions and near-extinctions of avian taxa in Sundaic Indonesia. *Forktail* **31**: 1–12.

Jepson, P. and R. J. Ladle (2005). Bird-keeping in Indonesia: conservation impacts and the potential substitution-based conservation responses. *Oryx* **39**: 1–6.

Jepson, P. and R. J. Ladle (2009). Governing bird-keeping in Java and Bali: evidence from a household survey. *Oryx* **43**: 364–374.

Jepson, P., Ladle, R. J. and Sujatnika (2011). Assessing market-based conservation governance approaches: a socio-economic profile of Indonesian markets for wild birds. *Oryx* **45**: 482–491.

Shepherd, C. R., Nijman, V., Krishnasamy, K., Eaton, J. A. and S. C. L. Chng (2015). Illegal trade pushing the Critically Endangered Black-winged Myna *Acridotheres melanopterus* towards imminent extinction. *Bird Conservation International* **26(2)**: 147–153.

Guidelines for Authors

The Journal of Indonesian Natural History will publish original work by:

- Indonesian or foreign scientists on any aspect of Indonesian natural history, including fauna, flora, habitats, management policy and use of natural resources
- Indonesian or foreign scientists on any aspect of regional natural history, including fauna, flora and habitats

Preference is given to material that has the potential to;

- Improve conservation intervention and management in Indonesia
- Enhances understanding of conservation needs in Indonesia
- Enhances the understanding of Indonesia's natural history

The Journal language will be in English with abstracts in Bahasa Indonesia as well as English. Authors of full papers are encouraged to provide a Bahasa Indonesia/English translation of their abstract. Submissions in Bahasa Indonesia will be accepted and translated into English only if accepted for publication.

Papers and Short Communications
Full Research Papers (2,000-7,000 words) and Short Communications (200-2,000 words) are invited on topics relevant to the Journal's focus, including:

- The conservation status, ecology or behaviour of wild species
- Status or ecology of habitats
- Prehistoric and extinct species and new findings
- Checklists of species, nationally or for a specific area
- Discoveries of new species records or range extensions.
- Biodiversity value associated with land use change, plantation development and forestry
- Biodiversity in High Conservation Value areas
- Reviews of conservation policy and legislation
- Conservation management plans for species, habitats or areas
- The nature and results of conservation initiatives, including case studies
- Sustainable use of wild species
- Community use and management of natural resources
- Abstracts of unpublished student theses (Short Communications only)

The Journal will not accept descriptions of new species, subspecies or other taxa.

How to Submit a Manuscript
Manuscripts should be submitted by e-mail to the Editor at:

editorjinh@jinh.org

In the covering e-mail, the Lead Author must confirm that:

- The submitted manuscript has not been published elsewhere,
- All of the authors have read the submitted manuscript and agreed to its submission,
- All research was conducted with the necessary approval and permits from the appropriate authorities

Review and editing
All contributors in English are strongly advised to ensure that their spelling and grammar is checked by a native English speaker before the manuscript is submitted to the Journal. The Editorial Team reserves the right to reject manuscripts that are poorly written.

Submission in Bahasa Indonesia is also accepted and the Journal secretariat will undertake a preliminary review of all manuscripts for suitability of content and format. Manuscripts that are rejected at this stage will not be sent for peer review and translation.

Manuscripts that pass through the preliminary review will be sent for translation and peer review by a minimum of two reviewers. Authors are welcome to suggest appropriate reviewers.

Proofs will be sent to authors as a portable document format (PDF) file attached to an e-mail note. PDF-readers can be downloaded free of charge from http://www.adobe.com and http://www.nitropdf.com for viewing PDF files. Corrected proofs should be returned to the Editor within 3 days of receipt. Minor corrections can be communicated by e-mail.

The Editorial Team also welcomes contributions to the other sections of the journal:

News
Concise reports (<300 words) on news of general interest to the study and conservation of Indonesia's natural history. News reports may include,

- Announcements of new initiatives; for example, the launch of new projects, conferences or funding opportunities.
- Announcements of important new reports or other publications related to Indonesian natural history.
- Summaries of important news from an authoritative published source; for example, new Indonesian species described in other journals, a new research technique, or a recent development in conservation.
- Summaries and analysis of new policies, decrees and laws relevant to the conservation of Indonesian natural history.

Letters to the Editor
Informative contributions (<650 words) in response to material published in the Journal.

Preparation of manuscripts
Full papers follow the style and format of papers published in the journal Conservation Biology. Authors should consult examples in Conservation Biology for guidance on general style.

Contributions should be in Bahasa Indonesia and/or UK English, double-spaced and in 'doc, 'rtf' or 'wpd' format, preferably as one file attached to one covering e-mail.

The cover page should contain;
The title and full mailing address, e-mail address and address of the Lead Author and all additional authors.

Contributing Papers should contain the following sections and be arranged in the following order: Abstract, Introduction, Methods, Results, Discussion, Acknowledgments, Literature Cited. Tables,

Figures and Plates (including legends), if included, should follow the Literature Cited.

All pages should be numbered consecutively. Do not number section headings or subheadings.

Title: This should be a succinct description of the work, in no more than 20 words.

Abstract: Abstracts should only be submitted for Full Papers. This should describe, in 100-300 words, the aims, methods, major findings and conclusions. It should be informative and intelligible without reference to the text, and should not contain any references or undefined abbreviations. Authors are encouraged to submit an English translation of Indonesian text and an Indonesian translation of an English text.

Keywords: From five to eight pertinent words, in alphabetical order.

Literature cited in text: Enclose citations in text in parentheses e.g. "Asian tapirs are no elephants when it comes to seed dispersal (Campos-Arceiz et al., 2011)."

Use an ampersand (&) between author surnames when the citation is parenthetical: (Traeholt & Idris, 2011).

When a citation is not parenthetical, use "and": "Our results agree with the predictions of Wolf and Rhymer (2001)."

For citations with more than two authors, use et al.: (Campos-Arceiz et al., 2011). Do not italicize et al.

List parenthetical citations in alphabetical order and chronologically from oldest to most recent and separate entries with a semicolon: (Campos-Arceiz et al., 2011; Geissman, 2009, 2010).

Separate the years with commas when citing multiple papers by the same author: (Corlett, 2007, 2010; Geissman, 1984, 1995, 1999, 2000).

"**In press**" means the cited paper has been accepted unconditionally for publication. Provide the year of publication in the text (Bird, 2010) and in Literature Cited section provide the volume number, and substitute "in press" for page numbers (Bird, I.M. 2010. Nesting success in arid lands. Conservation Biology 24: in press.).

Papers in review must be cited as unpublished and should not appear in the Literature Cited section.

Use an initial for the first (given) name and spell out the last name (surname) for other sources of unpublished data or information: (R. Fowler, unpublished data; M.E. Soulé, personal communication).

Software: capitalize the first letter only if the name of the program is a word (e.g., Vortex, ArcGIS). If the name of the program is not a word, use all capital letters (e.g., SAS).

The following are examples of Literature Cited house style:

Campos-Arceiz, A. and R.T. Corlett (2011). Big animals in a shrinking world—studying the ecological role of Asian megafauna as agents of seed dispersal. Innovation 10: 50–53.

Campos-Arciez, A., Larringa, A.R., Weerasinghe, U.R., Takatsuki, S., Pastorini, J., Leimgruber, P., Fernando, P. and L. Santamaria (2008). Behavior rather than diet mediates seasonal differences in seed dispersal by Asian elephants. Ecology 89: 2684–2691.

MacArthur, R.H. & Wilson, E.O. (1967). The Theory of Island Biogeography. Princeton University Press, Princeton, USA.

Sutherland, W.J. (ed.) (1998). Conservation Science and Action. Blackwell Science, Oxford, UK.

Beck, B.B., Rapaport, L.G. & Stanley Price, M.R. (1994). Reintroduction of captive-born animals. In Creative Conservation: Interactive Management of Wild and Captive Animals (eds P.J.S. Olney, G.M. Mace & A.T.C. Feistner), pp. 265-286. Chapman & Hall, London, UK.

Traeholt, C., Bonthoeun, R., Rawson, B., Samuth, M., Virak, C. and Sok Vuthin (2005). Status review of pileated gibbon, *Hylobates pileatus* and yellow-cheeked crested gibbon, *Nomascus gabriellae*, in Cambodia. Fauna & Flora International, Phnom Penh, Cambodia.

Sun H. (2000). Status of the tiger and its conservation in Cambodia. MSc thesis, University of Minnesota, Minneapolis, USA.

IUCN (2010). 2010 IUCN Red List of Threatened Species. Http://www.redlist.org [accessed 1 February 2011].

Biography: This should describe the main research interests of all authors (<150 words total), apart from what is obvious from the subject of the manuscript and the authors' affiliations.

Tables, figures and plates: These should be self-explanatory, each on a separate page and with an appropriate caption. Figures can be submitted in colour as well as in black and white. The Editorial Team may decide to convert coloured figures into black and white should it be necessary due to printing cost and without diluting the message. Plates (black and white only) will only be included in an article if they form part of evidence that is integral to the subject studied (e.g., a photograph of a rare species), if they are of good quality, and if they do not need to be printed in colour.

Appendices: Lengthy tables, and questionnaires are discouraged. In special circumstances these may be made available for viewing online.

Species names: The first time a species is mentioned, its scientific name should follow in parenthesis and in italics: e.g., Asian elephant (Elephas maximus). English names should be in lower case throughout except where they incorporate a proper name (e.g., Asian elephant, Cookson's wildebeest, long-billed vulture).

Abbreviations: Full expansion should be given at first mention in the text.

Units of measurement: Use metric units only for measurements of area, mass, height, etc.

Contents

ISSN: 2338 865x (print)
ISSN: 2685-5437 (online)