

The illegal trade of the Sumatran serow *Capricornis sumatraensis* for traditional medicine in Indonesia

CHRIS R. SHEPHERD^{1,*}, LALITA GOMEZ¹, BIOFAGRI A. RACHMAYUNINGTYAS²

¹Monitor Conservation Research Society, Big Lake Ranch, B.C., Canada

²Independent Researcher, Indonesia

*Corresponding author: chris.shepherd@mcrsociety.org

Submitted 6 September 2022; Accepted 19 October 2022

ABSTRACT

Mainland serow are in decline in Southeast Asia with poaching for illegal trade being a major driver. In Indonesia, where this species is found only on the island of Sumatra, the illegal wildlife trade is widespread and impacts numerous species and it is therefore not surprising to find serow in trade. Using seizure and prosecution data from 2014 to 2021, a total of 13 seizure records were obtained, involving an estimated minimum of 32 mainland serow (*Capricornis sumatraensis*). While legislation is in place in Indonesia to protect serow from poaching and illegal trade, meaningful penalties are seldom handed down. In an absence of effective deterrents, illegal trade will continue to be a threat to the conservation of this species.

ABSTRAK

Kambing hutan daratan utama mengalami penurunan di Asia Tenggara yang mana perburuan untuk perdagangan ilegal menjadi pendorong utama. Di Indonesia, di mana spesies ini hanya ditemukan di Pulau Sumatra, perdagangan satwa liar secara ilegal terjadi dimana-mana dan berdampak pada banyak spesies, oleh karena itu tidak mengherankan jika ditemukan kambing hutan dalam perdagangan ilegal tersebut. Dengan menggunakan data penyitaan dan penuntutan mulai tahun 2014 hingga 2021, diperoleh total 13 catatan penyitaan, dengan perkiraan minimal terdapat 32 ekor kambing hutan (*Capricornis sumatraensis*). Meski undang-undang telah ada di Indonesia untuk melindungi kambing hutan dari perburuan dan perdagangan ilegal, namun hukuman yang dijatuhkan jarang sepadan. Tanpa adanya pencegahan yang efektif, perdagangan ilegal akan terus menjadi ancaman bagi upaya pelestarian spesies ini.

Keywords: *Caprinae*, *poaching*, *Southeast Asia*, *Sumatra*, *wildlife trade*

INTRODUCTION

One group of species in Southeast Asia that few people have heard of is the serow (*Capricornis* spp). Based on recent taxonomy re-assessments the IUCN Red List of Threatened Species (hereafter the IUCN Red List) recognises four species of serow: the Japanese serow (*Capricornis crispus*) restricted to Japan; the red serow (*C. rubidus*) restricted to Myanmar, India and southwest China; the Formosan serow (*C. swinhoei*) restricted to Taiwan; and the mainland serow (*C. sumatraensis*) which includes the following subspecies – (*C. s. sumatraensis*) found in Indonesia, Malaysia and Thailand, (*C. s. mildneedwardsii*) found in Cambodia, China, Lao PDR, Myanmar, Thailand and Vietnam, and (*C. s. thar*) found in the Himalayan range (Phan et al, 2020).

Serows are threatened by widespread poaching and illegal trade almost everywhere they occur, yet surprisingly little attention has been given to their plight and conservation needs. Perhaps this is because specific trade-related research involving serows is extremely limited, and likely due to the limited attention this species receives from government and non-government conservation efforts overall. They are mainly hunted for their meat and parts (including horns, bones, feet, blood, teeth, innards) which are used in traditional medicines

(Duckworth et al, 2008a; Duckworth et al, 2008b; Duckworth & Than Zaw, 2008). Serow horns and heads are also traded as decorations and trophies. Surveys of wildlife markets in Southeast Asia show that serows are one of region's most utilised group of species, despite being totally protected across their range (Lekagul, 1965; Shepherd & Krishnasamy, 2014; Krishnasamy et al, 2019; Leupen et al, 2017; Nijman & Shepherd 2017; Shepherd, 2021). In some parts of their range, they have been extirpated due to poaching, sometimes in combination with habitat destruction (Shepherd & Krishnasamy, 2014).

Indonesia is home to one species of serow, (*C. s. sumatraensis*) also known as the Sumatran serow and is the only native species of the Caprinae family in the country. It occurs only on the island of Sumatra and is largely found throughout the Bukit Barisan mountains, especially in the Aceh highlands in the north of the island, the Kerinci highlands in the centre and the Barisan Selatan area in the south (Shackleton, 1997; Whitten et al, 2000; Phan et al, 2020). Assessed as Vulnerable by the IUCN Red List, the Sumatran serow is believed to be in significant decline due to over-hunting and habitat loss (Phan et al. 2020). While targeted poaching of serow is not uncommon, they are more

frequently caught in indiscriminate snares set for other species (Shackleton, 1997).

The Sumatran serow has been legally protected in Indonesia since 1932 under the Nature Protection Ordinance No. 1967 of 1932 (Shackleton, 1997). It is currently protected under the “Act of the Republic of Indonesia No.5 of 1990 concerning conservation of living resources and their ecosystems”, widely known as the “Conservation Act (No.5) 1990”, which is the principal legislation regulating wildlife trade in Indonesia. Under this Act, protected species are listed under “Government Regulation No.7, 1999, Concerning the preservation of flora and fauna”. Protected species may not be “caught, injured, killed, kept, possessed, cared for, transported, or traded whether alive or dead”. Exceptions are permitted by the Government for the purposes of research, science and/or safeguarding a species. Violation of this Act may result in a prison term of a maximum of five years and a fine of up to IDR100 million (~USD6,952). This species is also included in the revised list of protected species that was issued in 2018 by the Ministry of Environment and Forestry (P.106/MENLHK/SETJEN/KUM.1/12/2018).

Considering its protected status in Indonesia, and the dearth of information regarding the scale of poaching, uses, illegal trade and the efforts to counter this crime, we attempt to shed light on the illegal trade of serows based on an analysis of seizure data to identify the drivers behind the trade and the legal actions taking place to reduce the demand. We then make recommendations for further actions to be taken to better protect serow in Indonesia from illegal exploitation.

METHODS

To better understand the illegal trade of serow in Indonesia for the period 2014-2021, we collected seizure data from various sources including from media reports, published literature and unpublished literature and the government website, Sistem Informasi Penelusuran Perkara (SIPP)/case tracking system (an open access information database of the courts for each district). Online searches for seizures of Sumatran serow, known in Indonesian as *kambing gunung*, were conducted in both English (search terms: *Seizure of Sumatran serow*, *Sumatran serow smuggling*, *Sumatran serow illegal trade*, *Sumatran serow conservation*) and Indonesian (search terms: *BKSDA¹ kambing gunung/kambing hutan sumatera*, *penyelundupan kambing gunung/kambing hutan sumatera*, *perdagangan kambing gunung/kambing hutan sumatera*, *polisi satwa kambing gunung/kambing hutan sumatera*, *konservasi kambing gunung/kambing hutan sumatera*) with the Indonesian search terms being far more productive. All reported seizures and prosecutions were scrutinized to avoid duplication. We extracted information from each record on date of

seizure, commodity seized (live animals, horns, skull, skin, medicinal derivatives, etc), quantities of each commodity, purpose of hunting/trade (i.e., for consumption, use in traditional medicines), location of seizures and trafficking routes, suspects arrested and prosecution outcomes. Using the seizure data, we mapped points where trade exists. We have estimated a minimum number of serow recorded in trade from commodities seized, by either counting whole or near-whole specimens seized (e.g, live animals, skins), or by tallying quantities of body parts seized (e.g., horns, skull) that form one whole individual per seizure record. Due to inherent biases in the way seizure data are reported (given varying levels of law enforcement, reporting and recording practices, language biases, etc.), this dataset is interpreted with caution. Reported seizures are likely to represent only a fraction of the illegal trade and therefore the dataset presented here is not to be assumed as representing absolute trafficking trends or volumes.

Exchange rates used were USD 1 = ~ IDR 14,384.

RESULTS

From 2014 to 2021, a total of 13 seizures were obtained, involving an estimated minimum of 32 serows. On average there were one to two seizures each year except for four seizures in 2020. There were no reported seizures in 2015 and 2018. The greatest number of seizures occurred in West Sumatra (n=4) followed by Aceh (n=2) (**Figure 1**). The provinces of West Sumatra and South Sumatra were where the highest estimated number of animals were seized based on commodities confiscated. Only two seizures occurred outside the species' range i.e., in Java.

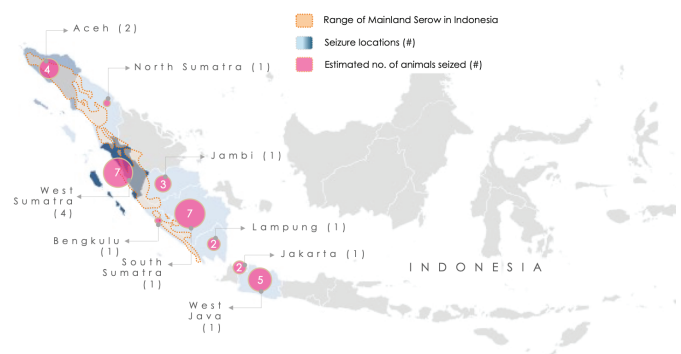


Figure 1. The range of the Sumatran serow (*C. s. sumatraensis*) in Indonesia and location of seizures that occurred between 2014 and 2021 including estimated number of animals involved in each incident.

All seizure incidents obtained, barring one, comprised the seizure of multiple species, their parts and derivatives (**Table 2**). This most frequently involved tigers (*Panthera*

¹Balai Konservasi Sumber Daya Alam – Indonesian Nature Conservation Agency

tigris) (n=7 incidents) and deer species (n=7 incidents) followed by sun bears (*Helarctos malayanus*) (n=5 incidents). At least three seizures were the result of investigations into illegal wildlife trade syndicates, three the result of raids on wildlife markets and a restaurant, three the result of information provided by members of the public, two the result of police checks at roadblocks and one the result of an investigation into the advertising of wildlife products on Facebook. Apart from one

incident, all seizures were successfully prosecuted (**Table 2**). However, the highest penalty imposed was 2.6-year (approximately 31 months) imprisonment and IDR50mil fine (~USD3,475) on two suspects in possession of body parts from serow, tigers, deer and birds poached from the Gunung Leuser National Park. The one incident where no one was arrested involved the killing and consumption of a serow by people living around a protected forest in Pematang, North Sumatra.

Table 1. The different commodities of the Sumatran serow seized from 2014 to 2021

Year	Commodity (Quantity)					
	Carcass	Head	Horn	Skeleton	Skin (pieces)	Skull
2014		2				
2016			3			1
2017		7	2	1	2	
2019		5			11	
2020		5	9			
2021	1		4			

Table 2. Seizure incidents involving Sumatran serow from 2014 to 2021 in Indonesia and prosecution outcomes

No.	Date	Seizure location	Commodity	Quantity	Suspects arrested	Prosecution outcome	Other wildlife seized
1	03/01/2014	Aceh	heads	2	2	1 year jail and IDR10mil (~USD695) fine or additional 4 months jail	tiger, clouded leopard, golden cat, leopard cat, sun bear, hornbill
2	15/01/2016	Jakarta Barat	skull horn	1 3	1	1 year jail and IDR50mil (~USD3,475) fine or additional 1 month jail	tiger, sun bear, deer, clouded leopard, golden cat, Bali starling leopards, birds of paradise, parrots, eagle, pythons
3	06/03/2017	Lampung	skeleton horn skin (pieces)	1 1 2	1	8 months jail and IDR5mil (~USD348) fine or additional 1 month jail	tiger, sun bear, rhino, Malayan tapir, deer, elephant, crocodile
4	27/04/2017	South Sumatra	head	7	1	7 months jail and IDR10mil (~USD695) fine or additional 1 month jail	leopard cat, golden cat, sun bear, muntjac, tiger, hornbill
5	19/02/2017	West Sumatra	horn	1	1	2 years jail and IDR30mil (~USD2,083) fine or additional 3 months jail	hornbill, deer
6	13/01/2019	West Sumatra	head	1	1	1.6 years in jail and IDR5mil (~USD348) or additional 2 months jail	part of a wildlife trade syndicate
7	04/04/2019	West Sumatra	heads skin (pieces)	4 11	2	6 months jail and IDR200k (~USD14) fine or additional 10 days jail	rhino heads, false gharial head and Sambar deer antlers

8	24/04/2020	Jambi	horns	5	1	2 years jail and IDR10mil (~USD695) fine or additional 2 months jail	tiger, pig-tailed macaque, deer, dugong, eagle
9	17/09/2020	Bengkulu	horns	2	1	5 months jail and IDR5mil (~USD348) fine or additional 2 months jail	Sambar deer
10	20/07/2020	West Java	heads	5	1	8 months jail and IDR5mil (~USD348) fine or additional 2 months jail	tiger, anoa, hawksbill turtle, saltwater crocodile, triton, nautilus, muntjac, deer, leopard cat, snake, sun bear, green peafowl
11	10/09/2020	West Sumatra	horns	2	2	7 months jail and IDR20mil (~USD1,390) or additional 2 months jail; 1.2 years jail and IDR40mil (~USD2780) or additional 3 months jail	pangolin, slow loris
12	01/03/2021	Aceh	horns	4	2	2.6 years jail and IDR50mil (~USD3475) fine or additional 2 months jail	deer, tiger, great argus
13	28/03/2021	North Sumatra	dead	1	-	-	-

DISCUSSION

The analysis of seizure data presented here shows that serows are being poached and illegally traded in Indonesia in violation of national legislation. Illegal exploitation of protected species is a common and widespread occurrence in Indonesia (Chng & Eaton, 2016; Gomez & Shepherd, 2021; Pires et al, 2021). Protected species, including their parts and derivatives, are sold openly in markets and shops across the country and, increasingly, via online platforms (Gunawan et al, 2017; Gomez et al, 2019; Thomas et al, 2021). Trade of serow parts, especially horns, have been observed occurring openly in souvenir shops in North Sumatra, especially in the mountain town of Brastagi (Shepherd & Magnus, 2004; Shepherd pers. obs., 1996, 2008). There were too few seizures involving serows in Indonesia to determine whether the species is targeted or caught incidentally by poachers. But a study on tiger poaching in the Kerinci Seblat National Park in Sumatra seemed to imply that snare traps found along mountain ridge trails were intended for serow (Linkie et al, 2003). Further, the fact that serow were found in trade on Java indicates demand and use beyond the species range in Indonesia.

Based on commodities seized (i.e., mostly heads and horns), the trade in serow parts appears to be mostly for traditional medicine and perhaps trophies. This corresponds with findings elsewhere in Southeast Asia

observed with an active trade in serows, their parts and derivatives (Leupen et al, 2017; Nijman & Shepherd, 2017; Phan et al, 2020). A recent study on the use of wildlife for traditional medicine in Indonesia found that serow is often used to treat skin and infectious diseases (Mardiastuti et al, 2021). In Lao PDR and Myanmar, the head, skeleton or parts of the serow are generally boiled or rendered down to obtain oil/fat which is then used to treat various ailments including arthritis and muscle and joint pain (Nijman & Shepherd, 2017; Davis & Glikman, 2020). In China, serow horn and blood are used for rheumatism relief (Mainka & Mills, 1995). In India, serow horns are used to treat abscesses (Velho & Laurance, 2013). Serow horns are also coveted for decorative purposes and its likely the same occurs in Indonesia. At least one seizure incident, occurring in a village in Pematang, North Sumatra, revealed that serow are also hunted for local consumption. Local authorities here (i.e., BKSDA) claimed this was largely due to a lack of awareness on wildlife conservation issues and regulations. Note however that as meat is likely consumed shortly after the animal is killed, it is less likely to detect serow meat in trade and therefore less likely for meat to be seized by the authorities.

All seizures analysed in this study, barring one, involved a number of other species and in some cases involved wildlife smuggling syndicates. This indicates

that serow were not specifically targeted by enforcement agencies. It may also explain the low number of serow seizures obtained for this study. For example, seven of the incidents included in this analysis involved tigers, which are a high profile and priority species for enforcement agencies. One incident was the result of an undercover investigation into five tiger poaching rings operating in North Sumatra (Parker 2014). The confiscation of serow parts was a by-product of these efforts. Investigations into the illegal trade of high-profile species clearly benefits lower priority species like serow. That said, neglecting to regulate the trade in lower profile species may mean that a large volume of illegal exploitation occurs undetected. The Sumatran serow is particularly vulnerable to the illegal wildlife trade considering its restricted range and threatened status.

The majority of cases in our dataset were prosecuted, yet the maximum penalty provided by the law (five years and fine of up to IDR100 million (~USD6,952)) was never imposed. Considering the numerous protected species seized in each incident, the low penalty outcomes show the little importance given to wildlife crimes as well as a lack of understanding or awareness on the impacts of the illegal wildlife trade. The illegal wildlife trade is among the greatest threats to biodiversity and is estimated to be worth billions of dollars (TRAFFIC, 2008; World Animal Protection, 2020). While it is debatable whether harsher penalties would deter potential offenders or reoffending criminals (Wilson & Boratto, 2021), the high value associated with species exploitation is more attractive if there is minimal risk associated with breaking the law (Ciavaglia et al, 2015). Given that serow parts have been openly observed in shops in Sumatra indicates that retailers are either unaware of the illegality of such trade or perceive the risk of being caught and sanctioned as low. Greater research on deterrence in wildlife crime is needed as we know little about what acts as an effective deterrent. The broader criminological literature suggests that the perceived certainty of being caught and sanctioned has a greater deterrent effect than perceived severity of punishment (see Wilson & Boratto, 2021). Looking at ways to improve the perceived likelihood of detection and prosecution could therefore prove beneficial and should be considered the subject of ongoing research.

CONCLUSION AND RECOMMENDATIONS

Serow populations are in decline across the entire range in Southeast Asia due to a large extent to the illegal wildlife trade (Phan et al, 2020). Given there is no recent estimate of the serow population in Sumatra, it is not possible to gauge the impact of the removal of 32 adult serow from the wild. However, as suitable habitat for serow in Sumatra continues to be destroyed and fragmented, and as encroachment into protected areas continues, it is likely that ongoing illegal offtake will have

a negative impact on the population overall. In the interest of conservation, more effort should be made to tackle the poaching and illegal trade of the Sumatran serow.

Indonesia currently has the legislation in place to protect the Sumatran serow. What is now needed is for government and non-government agencies and organisations monitoring wildlife trade in Indonesia to pay attention to the illegal exploitation of serow. Information gathered can be used to establish a baseline of availability from which to measure trade dynamics and threats and evaluate conservation measures and enforcement action. The information can also be used to support enforcement efforts to deter the poaching and illicit trade in serow parts and derivatives. Successful prosecutions relating to poaching serow, trading, possessing or using serow parts and derivatives should be highlighted in the media and other forums to raise awareness of the conservation needs of this species, the laws protecting it and the threat of prosecution for violating these laws. In this respect, local community engagement is warranted to address their role in the illicit sourcing and use of wildlife for meat and medicine. Strategies to reduce demand for serow parts and derivatives for traditional medicine should be developed, trialed and implemented in Indonesia. These measures are urgently needed considering the huge risk wildlife trade can pose through the possible transmission of zoonotic diseases.

Efforts to raise awareness of serow and their conservation needs among the general public would also be useful in enhancing overall efforts to protect this species, and this might be done through inclusion of serow in conservation education messaging and wildlife conservation campaigns.

ACKNOWLEDGEMENTS

We thank the Zoological Society for the Conservation of Species and Populations (ZGAP) for financial support. We thank Rae Boratto and Loretta Shepherd for helpful comments on an earlier draft.

REFERENCES

- Chng, S.C. & Eaton, J.A. (2016). *In the market for extinction: Eastern and Central Java*. TRAFFIC, Petaling Jaya, Malaysia.
- Ciavaglia, S., Dridan H., Kirkbride, K.P. & Linacre, A. (2015). Current Issues with the Investigation of Wildlife Crime in Australia: Problems and Opportunities for Improvement. *J. Int. Wildl. Law Policy*, 18:3, 244-263, DOI: 10.1080/13880292.2015.1074008.
- Davis, E.O & Glikman, J.A. (2020). An assessment of wildlife use by Northern Laos nationals. *Animals*, 10(4), 685.

- Duckworth, J.W., Steinmetz, R. & MacKinnon, J. (2008a). *Capricornis sumatraensis*. The IUCN Red List of Threatened Species 2008:e. T3812A10099434. <http://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T3812A10099434.en>. Viewed 6 January 2017.
- Duckworth, J.W., Steinmetz, R. & Pattanavibool, A. (2008b). *Capricornis milneedwardsii*. The IUCN Red List of Threatened Species 2008:e. T3814A10101852. <http://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T3814A10101852.en>. Viewed 6 January 2017.
- Duckworth, J.W. & Than Zaw (2008). *Capricornis rubidus*. The IUCN Red List of Threatened Species 2008:e.T3815A10102774. <http://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T3815A10102774.en>. Viewed 6 January 2017.
- Gomez, L., Shepherd, C.R. & Morgan, J. (2019). Revealing the online trade of Sun Bears in Indonesia. *TRAFFIC Bulletin*, Vol. 31 No. 2. Pp 67-71.
- Gomez, L. & Shepherd, C.R. (2021). The illegal exploitation of the Javan Leopard (*Panthera pardus melas*) and Sunda Clouded Leopard (*Neofelis diardi*) in Indonesia. *Nat. Conserv.*, 43: 25–39. <https://doi.org/10.3897/natureconservation.43.59399>.
- Gunawan, Paridi A. & Noske, R.A. (2017). The illegal trade of Indonesian raptors through social media. *Kukila*, 20: 1-11.
- Krishnasamy, K., Or, O.C. & Saaban, S. (2019). *From Seizures to Conviction – Stronger Penalties for Serow Offences in Peninsular Malaysia*. TRAFFIC, Southeast Asia Regional Office, Petaling Jaya, Selangor, Malaysia.
- Lekagul, B. (1965). *Threatened species of fauna in Thailand*. In: Talbot, L. M., Talbot, M.H. (eds), (1965). Conservation in tropical South East Asia: Proceedings of the conference on conservation of nature and natural resources in tropical South East Asia. IUCN, Bangkok, Thailand.
- Leupen, B.T.C., Gomez, L. & Shepherd, C.R. (2017). Recent observations of the illegal trade in serows in Lao PDR. *TRAFFIC Bulletin*, Vol. 29, No. 1, 37-40.
- Linkie, M., Martyr, D.J., Holden, J., Yanuar, A., Hartana, A.T., Sugardjito, J. & Leader-Williams, N. (2003). Habitat destruction and poaching threaten the Sumatran tiger in Kerinci Seblat National Park, Sumatra. *Oryx*, 37(1), 41-48.
- Mainka, S.A. & Mills, J.A. (1995). Wildlife and traditional Chinese medicine: supply and demand for wildlife species. *J. Zoo Wildl. Med.*, 193-200.
- Mardiastuti, A., Masy'ud, B., Ginoga, L.N., Sastranegara, H. & Sutopo, S. (2021). Wildlife species used as traditional medicine by local people in Indonesia. *Biodiversitas Journal of Biological Diversity*, 22(1).
- Nijman, V. & Shepherd, C.R. (2017). Ethnozoological assessment of animals used by Mon traditional medicine vendors at Kyaiktiyo, Myanmar. *J. Ethnopharmacol.*, Vol. 206, pp: 101–106.
- Parker, D., (2014). Indonesia police nab illegal wildlife traffickers in sting operation. Mongabay. <https://news.mongabay.com/2014/01/indonesia-police-nab-illegal-wildlife-traffickers-in-sting-operation/>. Accessed on: January 2022.
- Phan, T.D., Nijhawan, S., Li, S. & Xiao, L. (2020). *Capricornis sumatraensis*. The IUCN Red List of Threatened Species 2020:e.T162916735A162916910. <https://dx.doi.org/10.2305/IUCN.UK.2020-2.RLTS.T162916735A162916910.en>. Accessed on 14 December 2021.
- Pires, S.F., Olah, G., Nandika, D., Agustina, D. & Heinsohn, R. (2021). What drives the illegal parrot trade? Applying a criminological model to market and seizure data in Indonesia. *Biological Conservation*, 257, doi.org/10.1016/j.biocon.2021.109098.
- Shackleton, D.M. (ed.), The IUCN/SSC Caprinae Specialist Group (1997). *Wild Sheep and Goats and their Relatives. Status Survey and Conservation Action Plan for Caprinae*. IUCN, Gland, Switzerland and Cambridge, UK. 390 + vii pp.
- Shepherd, C.R. & Magnus N. (2004). *Nowhere to hide: The Trade in Sumatran Tiger*. TRAFFIC Southeast Asia. Petaling Jaya, Malaysia.
- Shepherd, C.R. & Krishnasamy, K. (2014). Observations of Illegal Trade in Sumatran Serows in Malaysia. *TRAFFIC Bulletin*, Vol. 26, No. 2, pp: 81-84.
- Shepherd, C.R., (2021). *Capricornis rubidus*. The IUCN Red List of Threatened Species 2021: e.T3815A22151023. <https://dx.doi.org/10.2305/IUCN.UK.2021-3.RLTS.T3815A22151023.en>. Accessed on 15 December 2021.
- Thomas, E.M., Nekaris, K.A.I., Imron, M.A., Cassey, P., Shepherd, C.R. & Nijman, V. (2021). Shifts of trade in Javan ferret badgers *Melogale orientalis* from wildlife markets to online platforms: implications for conservation policy, human health and monitoring. *Endanger. Species Res.*, Vol. 46: 67–78. <https://doi.org/10.3354/esr01142>.
- TRAFFIC (2008). *“What’s Driving the Wildlife Trade? A Review of Expert Opinion on Economic and Social Drivers of the Wildlife Trade and Trade Control Efforts in Cambodia, Indonesia, Lao PDR and Vietnam”*. East Asia and Pacific Region Sustainable Development Discussion Papers. East Asia and Pacific Region Sustainable Development Department, World Bank, Washington, DC.
- Velho, N., & Laurance, W.F. (2013). Hunting practices of an Indo-Tibetan Buddhist tribe in Arunachal Pradesh, north-east India. *Oryx*, 47(3), 389-392.

World Animal Protection (2020). Cruel cures: the industry behind bear bile production and how to end it. World Animal Protection. https://www.dropbox.com/s/2kzpdkfjn4vh347/Bear%20Bile%20Re-port_Cruel%20Cures_FINAL_compressed.pdf?dl=0.

Whitten, T., Damanik, S.J., Anwar, J. & Hisyam, N. (2000). *The ecology of Sumatra*. Periplus Editions, (HK) Ltd, Hong Kong.

Wilson, L. & Boratto, R. (2020). Conservation, wildlife crime, and tough-on-crime policies: Lessons from the criminological literature. *Biol. Conserv.*, 251, 108810.