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Trade in Southeast Asian Box Turtles from Indonesia: Legality, Livelihoods, Sustainability and Overexploitation

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Abstract: Southeast Asian box turtles *Cuora amboinensis* are distributed in mainland Southeast Asia and throughout most of insular Southeast Asia and are often found in habitats shared with humans. In the 2000s evidence emerged of an enormous illegal export of Southeast Asian box turtles from Indonesia estimated at a hundred times larger than the legal exports. Using publicly available data we show that one or two exporters in Sampit in the province of Central Kalimantan, one of nine provinces where harvest of Southeast Asian box turtles is authorised, continue to trade above permitted levels. Harvest quotas for Central Kalimantan are set at 1000 turtles a year, and this is divided between five approved traders, two of whom are based in Sampit. A single visit to one of these two traders in April 2019 documented the presence of 549 Southeast Asian box turtles. Based on documented data from middlemen we estimate that the number of Southeast Asian box turtles that are harvested in Central Kalimantan to supply the traders in Sampit amounts to 19,000–45,000 individuals a year. If the Sampit traders stay within their quotas potential profits are less than USD 400 year^{−1}, compared to up to USD 40,000 year^{−1} when trading the higher numbers. It is not known how many box turtles are traded by the other three exporters in the province. With the annual harvest quota for all of Indonesia set at less than 15,000 the massive illegal trade as documented in the 1990s and 2000s continues unabated. Assessments of the harvest and trade in Southeast Asian box turtles must consider both the sustainability and legality of this trade.

Keywords: anthropogenic impact; Asian turtle crisis; CITES; human impact; overcollection; sustainable livelihoods; wildlife conservation; wildlife trade



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1. Introduction

More than two decades ago, Shepherd [1], based on trade statistics, visits to processing facilities and discussions with collectors and exporters, showed that in the late 1990s there was a massive trade in live turtles from the Indonesian island of Sumatra. One of the most commonly traded species was the Southeast Asian box turtle *Cuora amboinensis*. These data suggested that, conservatively estimated, some 10 tonnes of turtles were exported every week from the cities of Medan (province of North Sumatra), Tembilahan (Riau) and Palembang (South Sumatra) to Singapore, China, and Hong Kong [1]. Taking the relative proportion of different species into account this implied that at the time ~700,000 Southeast Asian box turtles were exported annually from Sumatra alone. The large-scale trade appeared to have emerged in the mid-1990s and a few years later, at the time of Shepherd's survey, according to the traders and collectors, numbers of this and other turtle species had declined markedly in the wild [1]. This led some of the Sumatran traders to expand their collection areas to other parts of Indonesia, including Kalimantan, the Indonesian part of the island of Borneo [2].

The Southeast Asian box turtle is not a protected species in Indonesia (Peraturan Menteri Lingkungan Hidup dan Kehutanan Republik Indonesia Nomor 20), and while

there were no harvest quotas in the 1990s, these exports occurred largely unnoticed (see Discussion). In 2000 the genus was included on Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), thereby regulating all international trade. Following this, in 2001, the export quota for the species for all of Indonesia was set at 18,000 individuals. The gap between what traders previously exported, i.e., 100,000s of Southeast Asian box turtles a year, and what was now permitted, i.e., less than a few percent of this, suggested there was ample scope for illegal trade. This was indeed found by Schoppe [3] as part of a collaborative project between TRAFFIC and the Indonesian Ministry of Forestry (MoF, now Ministry of Environment and Forestry MoEF). Based on interviews with 18 Indonesian traders, she estimated conservatively that some 1,250,000 Southeast Asian box turtles were gathered annually for the illegal export to Malaysia, China, Hong Kong, and Singapore [3]. In a later, more comprehensive, report this was adjusted to “probably 100 times the volume of legal trade” [4]. This would amount to an annual export of 1,800,000 individuals.

In the years following, a number of studies focussed on various aspects of the trade in Southeast Asian box turtles from (specific regions within) Indonesia. Anderson et al. [5] presented data from three Indonesian processing facilities on the economics and trade data relevant to the international trade in Southeast Asian box turtles. Fauzi et al. [6] analysed data from the CITES trade database for the period 2000–2017 and found that from 2005 onwards Indonesia was the main supplier for Southeast Asian box turtles in international trade. Given that harvest and export quotas were seemingly set based on traders’ requests only (rather than non-detriment findings), they flagged up the need for credible science-based population data so that realistic quotas could be set to support a more sustainable trade. Ives et al. [7] noted that a modest but increasing number of Southeast Asian box turtles were harvested in Central Sulawesi to supply local ethnic Chinese, and international pet, food, and medicinal markets (the harvest quota for this province was zero at the time). Part of this supply may come from the turtles being harvested as ‘bycatch’ in traps set for fish, as it was documented in Southeast Sulawesi (another province without a harvest quota) that Southeast Asian box turtles were the species most frequently caught as bycatch [8]. Widagti [9] visited one of four middlemen in the town of Kota Bangun in East Kalimantan, and estimated that he shipped 7500 Southeast Asian box turtles year^{−1} to an exporter in Balikpapan, also in East Kalimantan. This was at a time when the quota for the entire province was capped at 5000 individuals. Fauzi et al. [10] presented data on the trade in Southeast Asian box turtles derived from visits to two traders in Sampit, Central Kalimantan and Palembang, South Sumatra, and noted trade above permitted quota levels, including for purposes not permitted under the current regulations (the purpose for which the species may be harvested and traded, e.g., pets, consumption, etc., is stated on the annually set quota). Finally, Fauzi [11] compared data on carapace length and mass of turtles at the premises of three commercial traders (based in Medan, Palembang and Sampit) in 2006 and 2019. He concluded that there was no evidence of a decline in size of the harvested turtles and that this might indicate that the harvest (and trade) is not yet detrimental to the wild populations.

We here focus on the human impacts, and specifically harvest and trade, on the status (numbers, diversity and distribution) of wildlife and the implications this has for wildlife conservation, using the Southeast Asian box turtle harvest in Indonesia as our case study. We do this by assessing the legality and sustainability of the domestic and international trade in these turtles from the province of Central Kalimantan, one of 32 provinces in which the species is found, as an illustration of the overall trade in this species in Indonesia, and to exemplify the lack of compliance with Indonesia’s overall harvest and trade quota system. We use publicly available information from the Indonesian government, research conducted by the Indonesian Institute of Sciences and data presented by other researchers to estimate the number of Southeast Asian box turtles that are harvested from this province. We combine these data with information on prices paid to collectors and middlemen to

make a monetary assessment of the trade both for collectors and traders, and how this can contribute to the livelihoods of collectors and traders.

2. Materials and Methods

2.1. Study Region, Species and Distribution

The Southeast Asian box turtle is widely distributed in lowland freshwater habitats, it is a habitat generalist, somewhat adaptable to anthropogenically altered habitats. Natural and human-modified habitats and their margins utilized by the species include marshes, creeks, mangrove swamps, ponds, peat swamp forests, shallow lakes, flooded rice fields, oil palm and rubber plantations that are either partly flooded or that have an extensive drainage system [12]. They are recognised for playing an important role in their ecosystems [13]; they are largely vegetarian, foraging on aquatic plants, but will also consume aquatic insects, molluscs and crustaceans [3,4]. Importantly, to the best of our knowledge, there is no reason for any conflict between humans and these turtles and with minimum effort humans and Southeast Asian box turtles should be able to co-exist. Within Indonesia, three subspecies are recognised that are identifiable by differences in their colour and shape of their carapace. The nominate *C. a. amboinensis* is found in eastern Indonesia, including Sulawesi, the Moluccas (including the island of Ambon, after which it is named), Timor and smaller islands. *Cuora amboinensis couro* is found in the southern part of Indonesia, including Sumatra, Java, Bali, Lombok and Sumbawa. In Borneo we find *C. a. kamaroma*, a taxon that is also found in parts of mainland Southeast Asia. The species matures slowly, with maturity reached after 5.5 to 6 years, and a low reproductive output of about six eggs per year per female [3,4]. Southeast Asian box turtles are traded for their meat, other body parts, and as pets [14]. The species has seen a rapid global decline. In 1994 it was considered Least Concern on the IUCN Red List of Threatened Species, in 1996 this was changed to Lower Risk/Near Threatened, in 2000 it was listed as Vulnerable, and in 2018 this was changed to Endangered [15].

2.2. Data Acquisition and Analysis

We both have lived and worked in Indonesia since the mid-1990s, we have been present at quota setting meetings, we collaborated with NGOs and government bodies and we have visited numerous reptile traders and processing facilities in the provinces of North Sumatra, Jambi, South Sumatra, Jakarta, West Java and East Kalimantan, amongst others. Our experience with Southeast Asian box turtle collectors has been mainly in South Sumatra, East and North Kalimantan (VN) and North Sumatra and Riau (CRS).

We here focus on the province of Central Kalimantan. Indonesia has a harvest quota system in place for Southeast Asian box turtles whereby annually each province is allocated a proportion of the total harvest (Table 1). In 2004, for the first time, Central Kalimantan was allocated a quota for the harvest of 2000 Southeast Asian box turtles for consumption (from 2001 to 2003 it was set at zero). In the years following this quota has fluctuated between 1000 and 2500. In addition, in most years 700 Southeast Asian box turtles are allowed to be harvested to be sold as pets. Approximately 90% of the harvest quotas are intended for export and ten percent for domestic use.

Quotas are given in number of individuals whereas the trade in turtles is frequently recorded in mass (kilogrammes or tonnes). The mass of Southeast Asian box turtles may differ between regions (e.g., Sumatra, Java, Borneo) and for converting mass to individuals we use data presented on Southeast Asian box turtles [4], i.e., 1.0 kg for turtles in Kalimantan and 0.75 kg for turtles in Sumatra.

Commenting on buying and selling prices, Jepson et al. [2] noted that “the most striking thing about these figures is the relatively low profit margin per kilo turtles taken by the two Mahakam traders. For the three species of turtle this is just IDR 2000 [corrected for inflation this equal USD 0.93 in December 2021]. This helps to substantiate the large trade volumes reported by the two traders interviewed”. We collected prices as reported in the literature, corrected these for inflation to December 2021 and then converted these

to US dollars. Using these price data, we make back-of-an-envelope calculations of the monetary gain the commercial traders in Sampit can make of the buying and selling of Southeast Asian box turtles, both if they stayed within their allocated quota and when using numbers based on extrapolation of observed numbers. Extending this we made a similar assessment for the value of the turtle trade to collectors and how this may contribute to their livelihoods.

Table 1. Harvest quotas (in number of individuals) for four commercially traded co-occurring freshwater turtles and tortoises for the year 2020. This trade is for meat and additional (smaller) numbers are allowed to be harvested to meet the demand for the pet trade. Asian leaf turtle also included *C. enigmatica*.

Province	Asiatic Softshell Turtle <i>Amyda cartilaginea</i>	Southeast Asian Box Turtle <i>Cuora amboinensis</i>	Asian Leaf Turtle <i>Cyclemys dentata</i>	Malayan Softshell Turtle <i>Dogiana subplana</i>
Aceh	3200	0	1500	200
North Sumatra	3450	1000	1000	0
West Sumatra	1200	500	2000	800
Riau	3000	1000	1500	300
Jambi	3150	1535	1000	0
South Sumatra	1500	500	2000	0
Lampung	0	0	500	0
West Kalimantan	1200	0	0	0
Central Kalimantan	2500	1000	0	0
South Kalimantan	2350	1500	1500	150
East Kalimantan	4800	500	0	150
West Java	0	0	0	200
Central Java	0	0	0	150
Central Sulawesi	0	1500	0	0
South Sulawesi	0	500	0	0

2.3. Estimates of the Minimum Number of Box Turtles Harvested in Central Kalimantan

The first estimate is based on data from Fauzi [11] and Fauzi et al. [10] who presented data on the number of Southeast Asian box turtles and black marsh turtles *Siebenrockiella crassicolis* collected in four districts surrounding the city of Sampit in the southern part of the province of Central Kalimantan that were delivered by collector teams to middlemen traders in Sampit (Table 3 in [10]). Fauzi et al. [10] indicated that in addition to these collector teams, local Sampit residents sold directly to the traders, but no estimates of the magnitude of this trade was presented. Based on data from Fauzi et al. [10] it was assumed that two-thirds were Southeast Asian box turtles; while black marsh turtles in trade tend to be smaller than Southeast Asian box turtles, erring on the cautious side, we assume these two species to have the same mass.

The second estimate is based on the statement from Fauzi et al. [10] that during their visit to one middleman in Sampit 549 Southeast Asian box turtles were recorded that were the result of a one-week harvest.

Harvest of box turtles is not equal in all months [2,4] (V. Nijman and C.R. Shepherd unpublished data), and for Sampit, harvesting is concentrated during the rainy season (October to April) as that is the turtles are most active (breeding) and more easily spotted. Fauzi et al. [10] conducted their survey at the end of this rainy season, and we assume the numbers they present are representative for the peak harvest season. Following Nijman et al. [16], who presented data on file snakes *Acrochordus javanicus* that were caught alongside box turtles in Indonesia, we conservatively assume that harvest during the dry season is 20% of what it is during the rainy season.

3. Results

There are five traders in Central Kalimantan that have been allocated a harvest quota for Southeast Asian box turtles. Two of these (UD Firdaus and UD Simun Sri) are based in Sampit; the others are based in Katingan Hilir (UD Anugerah Bessing), Arut Selatan (UD Kalpadruma) and Pangkalan Bun (CV Mufakat) (UD stands for Usaha Dagang or Trading Company and CV stands for Commanditaire Vennootschap or Limited Company). In the most recent years, from 2019 onwards, the provincial quota is 1000 of which 300 and 100 are allocated to UD Firdaus and UD Simun Sri, respectively.

Based on data from six collector teams we estimate that the number of Southeast Asian box turtles that are harvested in Central Kalimantan to supply the traders in Sampit amounts to 32,000–45,000 individuals a year. This is made up of between 23,000–36,000 individuals sourced from Kuala Pembuang, 7000 from Jemaras and 1000 each from Sembuluh and Katingan (Figure 1).

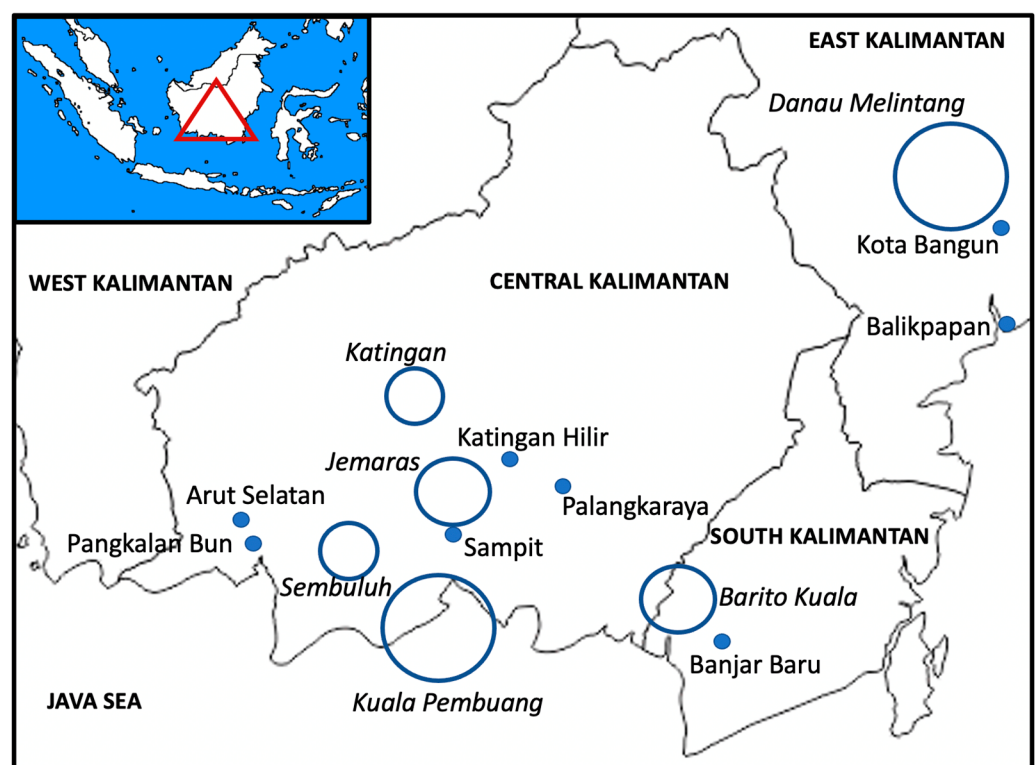


Figure 1. Trade in Southeast Asian box turtles *Cuora amboinensis* in Indonesian Borneo, with locations mentioned in the text. Blue dots with plain lettering depict towns or cities where traders and exporters are based, circles (roughly proportional to the number of turtles being harvested) represent source areas, with names in *italic*, names of provinces are in **bold**. The insert shows the location of Central Kalimantan within Indonesia.

During their visit in 2019, Fauzi et al. [10] recorded 549 Southeast Asian box turtles collected from Jemaras and Sembuluh. This resulted from one week of collecting during the peak season and adjusting for a lower catch during the dry season, this would suggest that annually some 19,000 Southeast Asian box turtles are collected. Comparable data from Kuala Pembuang (the main area where the species is collected), Katingan and Sampit is not available, but this would add considerably to this total, possibly four times this number.

Legally no more than 4200 turtles (2500 Asiatic softshell turtles *Amyda cartilaginea* with a minimum weight of 7 kg and 1700 box turtles) are allowed to be harvested each year in Central Kalimantan. Assuming a mean mass of 9 kg for a softshell turtle, at a price of USD 1.40 kg⁻¹ and a mass of 1 kg for a box turtle, at a price of USD 0.91 kg⁻¹, results in a maximum value of the turtle trade of USD 32,047. The 2021 government recommended

minimum wage for the region in which Sampit is situated was USD 209 month⁻¹; the total value of the legal turtle trade thus equals the income of fewer than 13 collectors on a minimum wage. Using a similar back-of-an-envelope calculation but including the four species of freshwater turtles that are legally allowed to be harvested for the commercial meat trade (Table 1), the number of collectors this industry can support is around 150 (91 collectors in Sumatra, 51 in Kalimantan, 3 in Java and 2 in Sulawesi). Even if we accept that an additional income of USD 100 month⁻¹ can make a significant difference in a household's livelihood, the number of people that can support themselves on this trade in all of Indonesia is less than five hundred in total.

Sampit traders at best can double their money by trading Southeast Asian box turtles when buying them for USD 0.91 kg⁻¹ and selling them for USD 1.82 kg⁻¹ (Table 2). This profit margin, when adjusted for inflation, is very similar to that reported by Jepson et al. (1998) from East Kalimantan, viz. USD 0.93 kg⁻¹. With the mass of a box turtle in Kalimantan in trade set at one kilogram, if the traders stay within their quota UD Firdaus can make USD 273 year⁻¹ and UD Simun Sri can make USD 91 year⁻¹. The higher estimate of 45,000 Southeast Asian box turtles traded from Central Kalimantan equals a potential profit of USD 40,950 year⁻¹ minus costs and expenses.

Table 2. Prices, in USD, of Southeast Asian box turtles *Cuora amboinensis*, or their parts, in western and central Indonesia, adjusted for inflation to December 2021. All prices are per kilogramme. Sources: V. Nijman unpublished data [1,2,4,5,9–11].

Location (Town/Village, Province, Island)	Type	1997	1999	2006	2019
Muara Muntai, E Kalimantan, Borneo	Live, middleman buying	3.73			
Kota Bangun, E Kalimantan, Borneo	Live, middleman buying		1.88–2.00	0.69–0.83	1.09–1.45
Sampit, C Kalimantan, Borneo	Live, middleman buying				0.91
Medan, N Sumatra, Sumatra	Live, middleman buying		2.51		
Pekanbaru, Riau, Sumatra	Live, middleman buying		1.74		
Duri, Riau, Sumatra	Live, middleman buying		1.53		
Jakarta, Java	Live, middleman buying				1.09–1.45
Banjarmasin, S Kalimantan, Borneo	Live, exporter buying	4.66			
Tembilahan, Riau, Sumatra	Live, exporter buying	8.30–8.79	2.79–3.00		
Kandis, Riau, Sumatra	Live, exporter buying		1.88–2.51		
Medan, N Sumatra, Sumatra	Live, exporter buying		4.26	1.94–2.22	
Jakarta, Java	Live, exporter buying			3.40	1.82
Jakarta, Java	Live, exporter selling				13.07
Medan, N Sumatra, Sumatra	Live, consumer, buying			5.55–6.94	
Palembang, S Sumatra, Sumatra	Live, consumer, buying			5.55	
Jakarta, Java	Live, consumer, buying			4.17–8.33	6.15
Banjarmasin, S Kalimantan, Borneo	Plastron, middleman buying			5.54	
Makassar, S Sulawesi, Sulawesi	Plastron, middleman buying			6.94	
Banjarmasin, S Kalimantan, Borneo	Plastron, exporter buying			9.58–9.72	
Pare-pare, S Sulawesi, Sulawesi	Plastron, exporter buying			9.03	
Surabaya, E Java, Java	Plastron, exporter buying			9.72	
Sampit, C Kalimantan, Borneo	Meat, consumer buying				1.06–1.41

4. Discussion

4.1. An Unnoticed Illegal Trade?

This is the fifth study that demonstrates that there is a large-scale trade, and export, in Southeast Asian box turtles, far above and beyond permitted levels. Data from Jepson et al. [2] suggests that about 5% of the turtle trade over a 10-month period from the Muara Muntai and Kota Bangun in East Kalimantan in 1997–1998 comprised Southeast

Asian box turtles, amounting to over 6000 individuals year⁻¹. A decade later Widagti [9] reported similarly high numbers from Kota Bangun, i.e., 7500 turtles year⁻¹. The quota for the entire province of East Kalimantan has never been more than 5000 individuals. Data from Shepherd [1] from Medan, Tembilahan and Palembang in Sumatra suggested an export of 700,000 Southeast Asian box turtles year⁻¹. Schoppe [3,4], arrived at a figure of 1.25 to 1.8 million Southeast Asian box turtles being harvested annually from all of Indonesia to meet the demand for export, against a national quota of 18,000. One can ask the question how it is possible that a species' whose international trade is regulated through CITES can be traded illegally in such quantities without it being noticed by the authorities. There are at least two, not mutually exclusive, possible answers. One centres on the turtles being fraudulently exported as fish or generic turtles, and the second centres on high levels of corruption, complacency and systemic collusion between the authorities and traders.

Under Indonesia's Fisheries Law, and its most recent amendment (regulation No 45, 2009), turtles and tortoises are defined as 'fish', alongside crocodilians, marine turtles, monitor lizards *Varanus* spp., water snakes and other kinds (reptiles) ("sebangsanya reptilia"). As such, their exploitation is managed by the Ministry of Marine Affairs and Fisheries (MoMAF), but Southeast Asian box turtles and other hardshell turtles are not considered a priority taxon for conservation (marine turtles and softshell turtles are). Turtles that are legally protected, as well as ones that are listed on CITES, fall under the responsibility of the Ministry of Environment and Forestry (MoEF). For Southeast Asian box turtles it is the MoEF that sets harvest and export quotas and, through its regional branches of the Natural Resource Management Agency (BKSDA) it is responsible for enforcing these quotas. The Department of Fisheries by and large uses a system whereby turtles are separated in hard-shelled turtles (kura kura, this includes the Southeast Asian box turtle) and soft-shell turtles (labi labi), but it does not distinguish between species [C.R. Shepherd and V. Nijman, pers. observ.] [1,4]. There are ambiguities over who has the mandate for carrying out quarantine inspections prior to export (MoEF or MoMAF). This differs between Jakarta and/or Java (where it typically is the MoEF) and the other provinces (where it is the MoMAF) and it differs between hard-shelled turtles (MoEF) and softshell turtles (MoMAF) [4]. Health certificates are typically issued without inspection of the animals, rather the quantity and species or type (hardshell, softshell) is noted. As such, it is likely that a significant part of the export of Southeast Asian box turtles is never recorded by the MoEF but instead it is handled by the MoMAF, classed as 'fish' or 'hardshell turtles', without inspection of species and without recording it as Southeast Asian box turtles. Overall, in the trade in Southeast Asian box turtles as well as other freshwater turtles, there appears to be a disconnect between the actions and responsibilities of implementing agencies.

Secondly, it is very well possible that the authorities are perfectly aware of the illegal trade in Southeast Asian box turtles but have opted not to act upon it. An ineffective legal and judicial system may hamper efforts to make the government more transparent and accountable to its citizens and it encourage corrupt behaviour. Toumbourou [17] flagged up how corruption explains the inefficiency of the MoEF. Linked to this, it was recognised that judicial corruption in Indonesia is systematic and institutionalised. This is made worse by a generally low level of judicial capacity, and bribes are an integral part of this (and thus are not linked to a few rogue individuals) [17]. The trade in Southeast Asian box turtles, while for a large part illegal, occurs very much in the open, as the risk of operations being shut down and/or traders being prosecuted, is perceived as very small. For instance, Shepherd [1] detailed that there were 22 cargo handling agencies involved in the export of turtles from North Sumatra alone, with thousands of turtles packed in warehouses awaiting export via air cargo to East Asian markets. It is near impossible to keep this concealed to the authorities and the trade took place openly. In 2006 over 6,000 Southeast Asian box turtle plastrons (the bony exoskeleton for the ventral side of the turtle) from Java were seized in Hong Kong, with a mean mass of ~90 grammes for each plastron [18]. While this shipment may have been smuggled out of Indonesia, in 2014 the Indonesian CITES authorities reported the export of 20,000 kg of carapaces to Taiwan to the CITES Secretariat

(in addition to 18,324 live ones; mostly to China, Hong Kong and Taiwan), indicating the authorities authorised this export. Taking the mass of a carapace and a plastron of 200 to 250 grammes, this suggest the approval of the trade in 80,000 to 100,000 Southeast Asian box turtles, above the agreed quota of 18,000 live ones, at a time when the export of plastrons or carapaces was not allowed [4]. This all suggests that at least some of the authorities are, or were, complicit in the illegal trade in Southeast Asian box turtles.

More broadly, none of the researchers reporting on trade in Southeast Asian box turtles indicate that this trade happens in any other way than in the open, with locations and/or names of trading companies and volumes reported in full [9–11]. This then suggests that there is a widespread tacit knowledge that a (significant) part of the trade in Southeast Asian box turtles is illegal, but there are no apparent efforts to change this.

4.2. Sustainability, Legality and Management

Recent assessments of the sustainability of the trade in Southeast Asian box turtles, or more correctly statements about its perceived sustainability, are all based on data collected from traders or at traders' facilities [1,9–11]. It is generally easier to measure changes in the numbers of animals that are exploited, or changes in other relevant biological characteristics such as morphological traits or sex ratio, rather than making assessments of the populations themselves [19]. Obviously, any assessment on the sustainability of the harvest needs to be based on at least two, or ideally more, points in time: the observation that large numbers of Southeast Asian box turtles are delivered to a trader, or the observation that an equal number of males and females enter the trade, in itself tells us very little about the sustainability of the trade [20]. Furthermore, any data on sustainability that is solely derived from observations at traders' combines changes in population size and changes in exploitation methodology [19] thus hampering making conclusions about the sustainability of the harvest.

Jepson et al. [2], focussing specifically on the turtle harvest in the East Kalimantan Mahakam Lakes wetland areas, concluded that periodic harvests during times of severe drought could conceivably be a sustainable strategy for utilization. This would have the benefit of providing a safety-net for fishermen during droughts as well as a justification for managing this diverse wetland ecosystem. However, by their own admission, their assessment of possible sustainability was not backed up by data on turtles, absence of changes in population structure, or population growth rates. The issue of livelihoods, and the debate to what extent the harvest and trade in Southeast Asian box turtles contributes to the livelihoods and monetary income of harvesters and middlemen is likewise hampered by lack of data. Our study contributes in that it makes it abundantly clear that if harvesters and middlemen operate within the law, Southeast Asian box turtles only represent a very small, minute even, part of these individuals' livelihood. Extending it to all species of freshwater turtle that are allowed to be harvested for the meat trade shows that at most 150 collectors throughout Indonesia can derive an acceptable (minimum) income from this; only when more is collected than what is permitted does this number go up.

Some excellent data on how turtle collection contributes to livelihoods from a setting similar to that of Sampit and surrounding wetlands, comes from a 11-year study on the livelihood strategies of a Dayak Benuaq community in East Kalimantan [20], in the same general area where studies have been conducted on Southeast Asian box turtle trade [2,9]. This long-term study revealed a highly dynamic pattern, with the principal income sources varying greatly from year to year, and this included high intensity short-term resource extraction of freshwater turtles. For most of the years between 1995 and 2006, the sale of turtles, including Southeast Asian box turtles, made up a very minor component of the Dayak Benuaq community's income. An exceptional long drought in 1997 and 1998 spurred the collection of large numbers of turtles and tortoises from swamp forests, which, through a chain of intermediaries, were exported to Hong Kong and Singapore [21]. The two-year collecting frenzy led to a depletion of stocks and a subsequent increase in the price of rattan (*Calamus crinitus* and *C. caesioides*), totally unrelated to the depletion of turtles, led to

a large-scale shift to rattan harvesting the following year. While Gönner [21] concluded that resource use, so far, has been genuinely sustainable, his measure (the disappearance of larger mammal or bird species) sets the bar unreasonably low. It also fails to take into account that the harvest of tortoises to meet the demand for the international trade (as opposed to for instance subsistence) was illegal under Indonesia's legislation at the time. Crucially, any statement of sustainability has to measure the effect of harvest on the population: we have no data on the recovery of the Southeast Asian box turtles in East Kalimantan but it is clear that harvest continues above agreed quotas [9].

Since 2000 Indonesia has reported the export of Southeast Asian box turtles to the CITES Secretariat. In most years, the number reported by Indonesia is close to its permitted export quota, and in many years, the importers report lower numbers. There are four years where specific importing countries report significantly higher numbers as being imported than Indonesia report as being exported, i.e., 2004, 2006, 2016 and 2017. In 2004 Malaysia reported the import of 20,500 Southeast Asian box turtles from Indonesia, the only year it reported importing any Southeast Asian box turtles; Indonesia did not report the export to Malaysia. In 2006 Hong Kong SAR reports the import of 19,509 Southeast Asian box turtles, 5253 more than Indonesia reports for that year. In 2016 and 2017, China reports the import of 20,531 and 19,512 Southeast Asian box turtles from Indonesia, 7251 and 7387, respectively, more than Indonesia reports exporting to China.

Schoppe [4] noted that more than once when she visited the premises of Southeast Asian box turtle traders, the number of turtles present on the day of the visit alone approached or exceeded the annual quota for the entire province. She noted "While it might have been a coincidence that the day of the visit to this trader was exactly the time he held most of his annual quota, it is more likely indicative that this trader was at risk of exceeding his quota throughout the year." (For a similar observation see Figure 2). Fauzi et al. [10] observed 549 Southeast Asian box turtles on the six days they visited the trader in Sampit whereas his or her annual quota could not have exceeded 300 individuals. Southeast Asian box turtles are only allowed to be harvested and traded for either the meat or pet trade; trade in plastrons is not permissible. It is however apparent that there is a substantial illicit trade in these plastrons, as a single shipment of plastrons from Java intercepted in Hong Kong in 2006 contained around 6600 Southeast Asian box turtle plastrons [22].

Clearly the quotas established on an annual basis for the harvest and export of Southeast Asian box turtles in Indonesia is ignored by harvesters and traders, including exporters. More worrying is the fact that this glaring unlawful trade has been apparently ignored for decades by the authorities in Indonesia responsible for the implementation and enforcement of laws and policies in place to ensure a sustainable and legal trade. Furthermore, the CITES administration has also failed to take effective measures to ensure international trade in this CITES-listed species is carried out at sustainable and legal levels in accordance with Indonesia's own legislation.

As Indonesia is one of the most significant exporters of reptiles globally [6], it is likely that such abuses are taking place across a number of other species, in violation of Indonesian regulations and undermining any attempts at ensuring the trade in these species is sustainable.

We call upon the Parties of CITES and the CITES Secretariat to investigate this issue as a matter of urgency, to ensure compliance with the Convention. We also call upon the Government of Indonesia to take measures to ensure permitted quotas are adhered to and that legal deterrents are utilised to prevent illegal and unsustainable harvest and trade that affects Southeast Asian box turtles.



Figure 2. Southeast Asian box turtles *Cuora amboinensis* are a trader's in Palembang, South Sumatra, Indonesia. On the day of the visit, it was estimated that 500 turtles were present—this was half the annual quota for the province of South Sumatra (photo: V. Nijman).

5. Conclusions

One of the aims of this study was to assess how human impact, in this case through harvest and trade, the status of wildlife, and what the implications this could have for wildlife conservation. We selected the Southeast Asian box turtles as our study species and found that (a) there is ample evidence of overharvesting above agreed quotas, (b) the trade is largely to meet international demand thus violating international agreements, (c) legal harvest and trade in Southeast Asian box turtles contributes very little to the livelihoods of local collectors and middlemen—only through harvesting many more tur-

bles than is legally allowed can the harvest and trade provide a substantial (addition to) income, and (d) hitherto there is no information on the sustainability of the harvest and trade, but the scale of the overharvest (one or two orders of magnitude), and reports of depleted populations and collectors shifting to alternative income sources suggest it is not sustainable.

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