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Regular Research Article

Tracing Current Wildlife Trade: An Initial Investigation in Makassar City, Indonesia

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Abstract: Wildlife trade has become one of the main causes of species loss and extinction. Increasing anthropogenic pressure posits crucial challenges to wildlife, and several species are threatened or at the edge of extinction. In this study, we aimed to examine the current wildlife trade in Makassar City of South Sulawesi, especially focusing on traded species, their area of origin, price, conservation status and traders' distribution across the city. We conducted a market survey and direct observations of animals and wildlife traders in several locations, using a questionnaire targeting both wildlife/pet sellers and buyers. We also interviewed government bodies related with wildlife trade. Our results showed that there were 13 distribution spots of wildlife trading in the city of Makassar, and 27 different wildlife suppliers. During the seven months of observation (March-September 2018), the trade involved 62 species of birds, mammals and reptiles. More than 50% of these species had Indonesian origins, and 18% were endemic species of Sulawesi Island. The highest number of animals traded in the market were birds. Out of the 2,642 individuals being traded, 32 were considered as protected species under the IUCN regulation, 24 were species whose trade is regulated by CITES, and 10 were nationally protected according to the Indonesian Government's Laws. The traded animals were obtained from different sources, including direct hunters, middlemen, opportunists, and breeders, mostly from Sulawesi (44.19%) and western parts of Indonesia (37.21%).

Keywords: Wildlife trade; declining population status; illegal trade; wildlife trader's distribution; wildlife key players and networks

1. Introduction

Wildlife trade has become one of the main causes of species loss and extinction (IUCN, 2007; Harris et al., 2017), and the main threat for biodiversity conservation (Phelps et al., 2010). Wildlife trade involves not only selling but also exchanging wild animals, plants and fungi, and any products originating from their body parts (Nijman et al., 2019), including by-products such as meat, bones, feathers, skins, oils (fats), seeds, leaves, or fruits (Cooney et al., 2015). For many countries, the primary motivate to engage in the wildlife trade is economic, although the profits generated from wildlife trade varies to some extent depending on the key players and continuously evolving trade chains (TRAFFIC, 2008; Nijman et al., 2019). In response to increasing human population and economic growth, demand for natural resources, in particular wildlife, has escalated all across the world (Gaulke & Fritz, 1998; World Bank, 2005). This has led to unsustainable harvest of wildlife, and illegal wildlife hunting and trading (TRAFFIC, 2008), which are now the primary causes of biodiversity loss in Indonesia (Harrison, et al. 2016).

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Sulawesi is one of the major islands of the Wallacea Region, and is known as habitat for many endemic species. However, together with the other four largest islands in Indonesia, Sulawesi has recently experienced a significant decrease in biodiversity and in particular in its fauna, due to wildlife consumption and trade (Sheherazade & Tsang, 2015; Latinne et al., 2020). The island has become one of major suppliers of wild animals being traded or smuggled to the western parts of Indonesia and other countries (Millner-Gulland & Clayton, 2002; Lee et al., 2005; Bashari, 2015). Makassar, the capital city of South Sulawesi Province, is known to be the gateway to eastern Indonesia and it is therefore likely to be an important hub for wildlife trading. Recently, for instance, the area was identified as a local transit route for parrot trading from the Wallacea Region (Bashari, 2015).

To date, however, there has been to our knowledge no systematic assessment of the current wildlife trading activities in the area. This study is an initial investigation into the wildlife trade in the city of Makassar, focussing on enumerating and mapping the presence of wildlife markets, identifying the species traded, number and prices of animals, their conservation status, and the key players and networks involved in this illegal trade. This information is crucial to understand the impact of wildlife trading in the area, and can further be used to prevent greater losses of some species of fauna in the Wallacea Region.

2. Study Area and Methods

The study was conducted from April to September 2018. The study site included places that are likely involved in wildlife trade in Makassar, the capital city of South Sulawesi Province. A set of questionnaires was distributed to participants, in order to obtain (i) socio-demographic information on the key players of the illegal wildlife trade, (ii) information on the wildlife being traded in Makassar City (type of animals traded, numbers and price of traded animals, reasons for trading) and (iii) on participants' awareness of protected species. Participants were wildlife/pet sellers, buyers, and government entities. They were informed that information on their identities would not be disclosed and would be considered confidential (Hasanuddin University Ethical Clearance Board No.1725/UN.4.14.8/TP.02.02/2019). The data were collected during the day between 10.00 and 17.00 hours. Later, the location of main local markets/pet shops in Makassar City were mapped by using the ArcGIS application to generate an aerial map with wildlife trading sites. Survey data was analysed using SPSS version 17.0 to provide a general description of wildlife trade in the area.

3. Results

3.1 Market sites

We identified two wildlife markets and 11 pet sellers in Makassar City (South Sulawesi Province). The wildlife/pet sellers were distributed in 6 districts of Makassar City with 13 marketing spots across the city (Figure 1). Most of the sellers were located in Rappocini and Ujung Pandang Districts. Both districts are located in the center of the city close to the toll roads, sea port, airport, and other access routes to other regencies of South Sulawesi Province. However, the highest number of sellers was located in Pasar Hobi, Rappocini District, with a total of 50 shops mostly displaying bird species.

3.2 Current Wildlife Trade

Based on our observations and on the survey responses from the wildlife/pet sellers in Makassar, the total number of species found in the market was 62, with a total of 2,642 individuals from various groups of animals (birds, mammals, reptiles). The highest number of animals traded were birds (37 species; Table 1). Moreover, 45% of the mammals sold in shops were wildlife species (the remainder were domesticated pets). Out of the 62 species traded in Makassar markets, 33 species had an Indonesian origin (53.2%), and 18% of these were endemic to Sulawesi Island (N=6 species). Furthermore, 58.06% of the species sold in the markets were reported as having been obtained from the wild, and 41.93% were domesticated species.

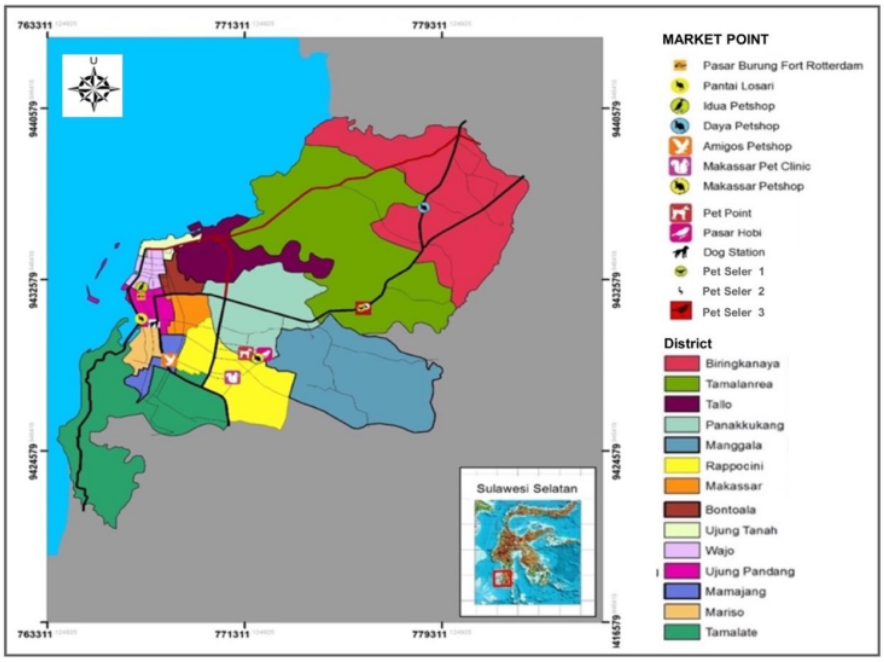

Figure 1. Distribution Map of wildlife/pet trade location in Makassar City

Among the 62 species traded in the markets of Makassar City, 25.8% were listed under both national and international regulations. There were 5 species (8.1%) protected by both IUCN and CITES, such as Fischer's lovebird (*Agapornis fischeri*), common barn owl (*Tyto alba*), Wallacean box turtle (*Cuora amboinensis amboinensis*), and two species of pythons (*Python molurus* and *Malayopython reticulata*). Only piping crow (*Corvus typicus*) was listed by the IUCN as a species of *Least Concern* (LC), and was protected by the national regulations. Some species with a high conservation status by the IUCN were freely displayed in the market, including Nias hill myna (*Gracula robusta*) and yellow-crested cockatoo (*Cacatua sulphurea*). In the market, we also found species with an Endangered status, like purple-napped lory (*Lorius domicella*) and Wallacean box turtle (*Cuora amboinensis amboinensis*), and species with a Vulnerable status, like Burmese python (*Python molurus*). Three other traded species were *Near Threatened* (NT), like Fischer's lovebird (*Agapornis fischeri*), blue-streaked lory (*Eos reticulata*), and Tanimbar corella (*Cacatua goffiniana*). For the reptiles, two species were categorized as *Vulnerable*, the Wallacean box turtle (*C.a. amboinensis*) and the Burmese python (*Python molurus*), the latter also protected by national legislation. Moreover, there were 17 species that were locally protected by the government, most of them being bird species (94.1%). No mammals traded in the markets/pet shops were classified as having a high priority conservation status under both national and international policies.

Table 1. List of animal species traded in Makassar City (South Sulawesi Province), including their conservation status (CR= Critically Endangered; EN= Endangered; NT= Near Threatened; V= Vulnerable; LC=Least Concerned; NE=Not Evaluated; API=Appendix I; APII=Appendix II; P= Protected; UP=Unprotected; NA=Not Available), number of individuals being traded and price range

No	Local Name	Scientific Name	STATUS			Number of Individuals found in the market	Price Ranges (USD)
			IUCN	CITES	Indonesian's Laws & Regulations		
		BIRDS					
1	Nias hill myna	*Gracula religiosa robusta*	CR	APII	P	3	**120-350**
2	Common hill myna	*Gracula religiosa*	LC	APII	P	19	150-300
3	Pipping Crow	*Corvus typicus*	LC	NA	P	7	35-40
4	Blue-backed parrot	*Tanygnathus sumatranus*	LC	APII	P	69	**20-35**

No	Local Name	Scientific Name	STATUS			Number of Individuals found in the market	Price Ranges (USD)
			IUCN	CITES	Indonesian's Laws & Regulations		
5	Eastern Spotted dove	*Streptopelia chinensis*	LC	NA	UP	14	N/A
6	Rock dove	*Columba livia domestica*	LC	NA	UP	10	N/A
7	Orange-headed thrush	*Zoothera citrina*	LC	NA	UP	6	75-80
8	Fischer's lovebird	*Agapornis fischeri*	NT	APII	UP	8	75-80
9	Budgerigar	*Melopsittacus undulatus*	LC	NA	UP	58	60-75
10	Black-naped oriole	*Oriolus chinensis*	LC	NA	UP	8	35-50
11	Black-ringed White-eye	*Zosterops anomalus*	LC	NA	UP	103	
12	Red Jungle Fowl	*Gallus gallus*	LC	NA	UP	4	N/A
13	Domestic bantam chicken	*Gallus* spp.	NA	NA	UP	4	N/A
14	Grosbeak starling	*Scissirostrum dubium*	LC	NA	UP	42	N/A
15	Blue-streaked lory	*Eos reticulata*	NT	APII	**P**	14	N/A
16	Ornate lorikeet	*Trichoglossus ornatus*	LC	APII	**P**	14	**35-40**
17	Black-capped lory	*Lorius lory*	LC	APII	**P**	1	N/A
18	Yellow-crested cockatoo	*Cacatua sulphurea*	CR	API	**P**	1	N/A
19	Tanimbar corella	*Cacatua goffiniana*	NT	API	**P**	1	**65**
20	Island Canary	*Serinus canaria*	LC	NA	UP	24	50-120
21	Black-winged kite	*Elanus caeruleus*	LC	APII	**P**	1	N/A
22	Long-tailed shrike	*Lanius schach*	LC	NA	UP	7	N/A
23	Yellow bittern	*Ixobrychus sinensis*	LC	NA	UP	10	1-2
24	Sulphur-crested cockatoo	*Cacatua galerita*	LC	APII	**P**	3	**300**
25	Barn owl	*Tyto alba*	LC	APII	UP	1	N/A
26	Zebra dove	*Geopelia striata*	LC	NA	UP	114	7.5
27	Streaked weaver	*Ploceus manyar*	LC	NA	UP	97	2-2.5
28	Sooty-headed Bulbul	*Pycnonotus aurigaster*	LC	NA	UP	36	
29	Domesticated fowl	*Gallus domesticus*	NA	NA	UP	2	N/A
30	Mollucan Eclectus	*Eclectus roratus*	LC	APII	**P**	1	N/A
31	Black lory	*Chalcopsitta atra*	LC	APII	**P**	2	N/A
32	Yellowish-streaked lory	*Chalcopsitta scintillata*	LC	APII	**P**	3	N/A
33	Purple napped lory	*Lorius domicella*	EN	APII	**P**	5	N/A
34	Dusky lory	*Pseudeos fuscata*	LC	APII	**P**	1	N/A
35	Philippines fowl	*Gallus* spp.	NA	NA	UP	1	100
36	Polish fowl	*Gallus* spp.	NA	NA	UP	1	45
37	Giant fowl	*Gallus* spp.	NA	NA	UP	2	45
		MAMMALS					
1	Hamster	*Phodopus campbellii*	LC	NA	UP	253	0.5-2.5
2	Rabbit	Family Leporidae	NA	NA	UP	133	25-7.5
3	House mouse	*Mus musculus*	LC	NA	UP	236	0.5-1.5
4	Persian cat	*Felis* sp.	NA	NA	UP	31	250-350
5	Sugar glider	*Petaurus breviceps*	LC	NA	UP	5	
6	Four-toed hedgehog	*Atelerix albiventris*	LC	NA	UP	2	N/A
7	European hedgehog	*Erinaceus eropaeus*	LC	NA	UP	3	N/A
8	Siberian husky dog	*Canis* sp.	NA	NA	UP	3	700
9	Labrador dog	*Canis* sp.	NA	NA	UP	5	N/A
10	mini pom dog	*Canis* sp.	NA	NA	UP	7	150-350
11	Doberman dog	*Canis* sp.	NA	NA	UP	3	N/A
12	Pit bull dog	*Canis* sp.	NA	NA	UP	2	N/A
13	Rottweiler dog	*Canis* sp.	NA	NA	UP	2	N/A
14	Shitzu dog	*Canis* sp.	NA	NA	UP	6	N/A
15	Golden retriever dog	*Canis* sp.	NA	NA	UP	1	200-600
16	Maltese dog	*Canis* sp.	NA	NA	UP	5	18
17	Mini peking dog	*Canis* sp.	NA	NA	UP	5	N/A
18	Herder	*Canis* sp.	NA	NA	UP	2	N/A
19	Angora cat	*Felis* sp.	NA	NA	UP	3	N/A
20	Himalayan cat	*Felis* sp.	NA	NA	UP	1	N/A
		REPTILES					
1	Red-eared slider	*Trachemys scripta elegans*	LC	NA	UP	10	3.5-4
2	Wallacean Box turtle	*Cuora amboinensis amboinensis*	VU	APII	UP	1	15
3	Iguana	*Iguana iguana*	LC	APII	UP	1	80
4	Burmese python	*Python molurus bivittatus*	VU	API, II	**P**	12	120-800
5	Reticulated python	*Malayopython reticulata*	LC	APII	UP	4	120

In terms of price, the selling prices ranged from 1 to 350 USD for birds, with the least expensive being an endemic bird of Sulawesi, the black-ringed white-eye bird (*Zosterops anomalus*), and the most expensive one being Nias hill myna (*Gracula religiosa robusta*). The highest number of birds from one species found in the market belonged to the species Zebra dove (*Geopelia striata*), with 114 individuals. Wildlife mammals species found were sugar glider and hedgehogs which only sugar glider known to be sold for less than 100 USD. There were only 5 species of reptiles being traded, with no more than 15 individuals found in the markets of Makassar City. The Wallacean box turtle (*C. a. amboinensis*) was also traded in the market, with a price almost five times higher than that

given for the red-eared slider turtle (*Trachemys scripta elegans*). However, *C.a. amboinensis* was very rarely traded in Makassar City, with only one individual found in the market in this survey.

3.3 *Wildlife trade key players and networks*

Information on wildlife trade was obtained from 20 respondents who owned wildlife/pet shops in Makassar City (South Sulawesi Province) and were willing to be interviewed. Around 80% of the economic activities were run by male owners (N=16 people) as their primary occupation. Based on the information obtained, the number of years over which they had been involved in animal trading ranged between 1 and 5 years for 30% of the respondents, and from 5 to 10 years for 10% of the respondents, while the rest of the respondents provided no answer to our questions. The motivation to pursue this economic activity was mostly "hobby", whereas only 3 respondents mentioned profit as their reasons to be engaged in the activity (Figure 2).

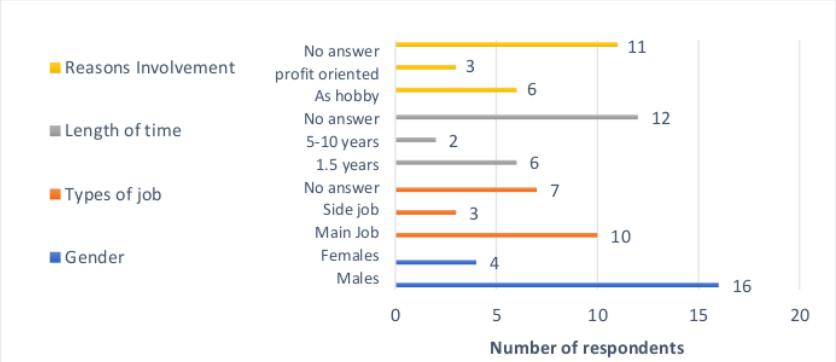

Figure 2. Profiles of wildlife/pet sellers in Makassar City (South Sulawesi Province)

We also explored the sources of wildlife being traded in the markets (Figure 3). Twenty respondents identified 27 suppliers, belonging into 4 categories: direct hunters, middlemen, opportunists, and breeders. Sellers could obtain the animals from hunters who sold their prey directly (direct hunters), or from other sellers (middlemen). Sellers could also obtain animals from opportunists, defined as people who unintentionally caught the animals and then sold them to the sellers, or from breeders, defined as people who have the ability to breed animals and sell them to other parties. Three wildlife/pet sellers claimed to be supplied by direct hunters and twelve sellers by middlemen, whereas the others obtained animals from breeders (6 respondents) or opportunists (6 respondents). The animals mostly originated from the Sulawesi area (44.19%) and the western part of Indonesia (37.21%). The phillipine was identified as one source country in supplying imported animals illegally.

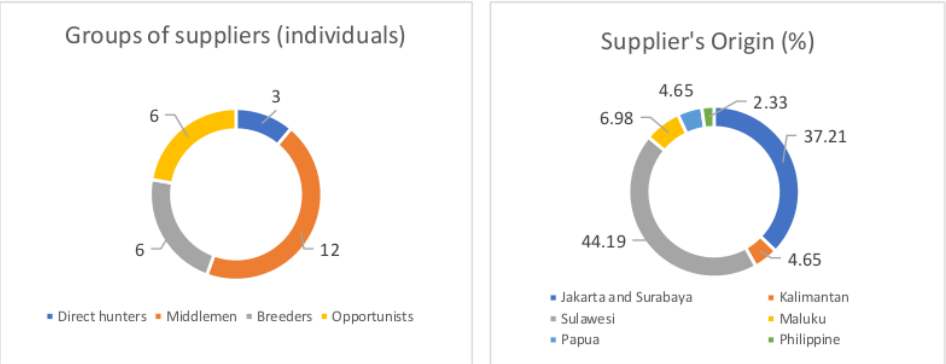

Figure 3. Origins of suppliers for group and source areas of wildlife trade in Makassar

We also included questions on the awareness of wildlife/pet sellers towards the conservation of the traded species (Figure 4). Regarding the protection status of animals under national/international policies, 74% of respondents answered that they did not know the species on sale was protected by laws. Only 13% of respondents claimed to have experienced inspections by the government (National Agency for Nature Conservancy), whereas 70% had no experience or encountered inspections by the government. To date, the majority of respondents stated that there were no collaborations established between the wildlife/pet sellers and the government (70%). In terms of collaboration between the government and wildlife/pet sellers, only 13% respondents answered positively where they were involved in routine inspection, socialization, and quota determination. Moreover, knowledge about the species protection status was very low for all respondents, with only 9% respondents being aware of the species protection status, and most respondents not being aware (>70%).

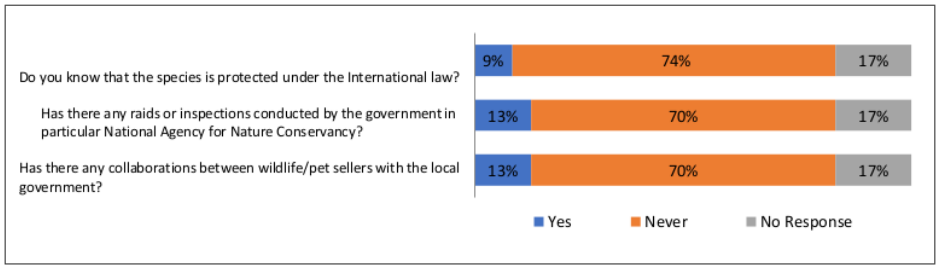

Figure 4. Awareness on wildlife conservation and linked between wildlife/pet sellers and government of Makassar City

In our interviews, we also included other key players on wildlife trade in Makassar City, specifically buyers and representatives from the authorities in wildlife trade. There were only six buyers who were willing to be interviewed. The backgrounds of respondents varied from civil servants, college students, to entrepreneurs. The reason to buy animals was mainly interest or hobby (67%). All respondents knew about the species protection status (100%), and most respondents claimed they had never kept or bought a protected species (83%). Only one respondent indicated interest to buy or keep protected species, and 4 respondents were aware of the legal consequences of keeping or buying protected species.

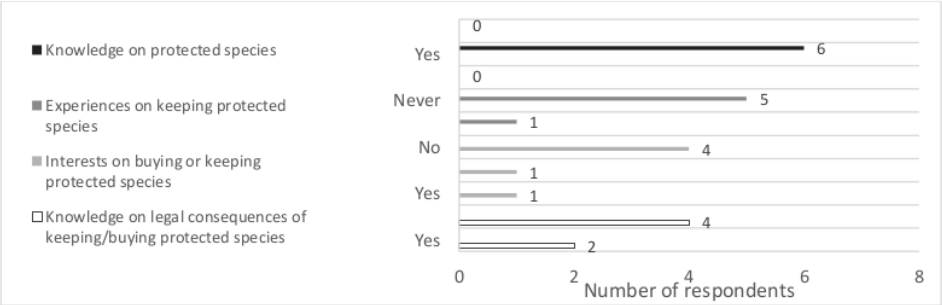

Figure 5. Perspectives of buyers on protected species traded in Makassar City (N=6 respondents)

Lastly, we also conducted interviews with the National Agency for Nature Conservation and the National Agency for Agricultural Quarantine of South Sulawesi Province. In particular, we asked questions on the link between wildlife trading and governmental agencies (Table 2). There were two main points raised: the role of government agencies in wildlife trade and experiences/difficulties in tackling wildlife trade (Table 2). The National Agency for Agricultural Quarantine is responsible for conducting inspections on health-related conditions of flora and fauna entering or exiting Makassar

City. In contrast, the National Agency for Nature Conservation is responsible for controlling wildlife trade in the region and providing captive permits. Our interviews showed that in Makassar City, no sufficient data or proof had ever been found to bring wildlife traders to court.

Table 2. Interview results obtained from the governmental entities related with wildlife trade

	National Agency for Nature Conservation (Balai Besar Konservasi Sumber Daya Alam-BBKSDA)	National Agency for Agricultural Quarantine (Balai Besar Karantina Pertanian-BBKP)
People interviewed	Coordinator of Wildlife Trade Division	Head of Animal Quarantine Division
Roles of Government Agency in Wildlife Trade	• Handling wildlife trade inter regions, inter islands and between countries • Processing and declaring permits for captivity activities • Confiscating animals and legally processing the violators of wildlife crimes • Conducting routine patrol in wildlife/pet markets • Proposing quota for wildlife trade	• Controlling wildlife transported at the port and airport • Monitoring protected wildlife during transfer in collaboration with the National Agency for Nature Conservation • Checking for health-related conditions of animals entering or exiting the island • Declaring exit/entry permits as well as quarantine permit for any animals known to be exiting or entering any islands.
Experiences and difficulties in handling wildlife trade cases	• Implementing national regulations/policies on wildlife trade cases • Establishing collaboration with captive breeders on breeding some protected species • Conducting inspections in several wildlife/pet sellers • Handling many cases on wildlife trading and confiscating animals through legal framework (11 cases) including on line trading • Conducting routine patrol/integrated inspections 10-12 times per year collaborating with other legal units • Difficulties found in detecting any violation occurring related with wildlife trade in Makassar were due lack of proof and in sufficient data to press charges and limited staff • Lack of awareness of wildlife/pet sellers though routine socialization and awareness program given to wildlife/pet sellers and captive breeders • Insufficient ecological and biological of species data for determining quota	• Never directly involved in monitoring wildlife trade in the markets in Makassar mostly at entry/exit gates – no direct access to prevent zoonotic diseases at the market level • Establishing collaboration with the national agency for nature conservation (BBKSDA) through direct reporting if any protected species spotted at the entry/exit gate • Limited skills and knowledge of staff in identifying rare or protected species both plants and animals

4. Discussion

Wildlife trade has become an important business in South Sulawesi Province, especially in Makassar City. The location of wildlife/pet sellers was scattered in 6 districts of the city. However, most of the markets were located in two districts in the center of the city. The strategic locations of the markets have made them accessible for potential buyers from other parts of the city, as well as from other areas outside Makassar, as these locations are very close to entry/exit points of the city (toll roads, seaport, airport, and provincial roads). Our investigation in the markets of Makassar City has revealed a wide range of wildlife on sale, with 62 species (birds, mammals, and reptiles) found in the markets. Most of the species traded were originally from Indonesia (>50%), 18% were species endemic to Sulawesi Island and 58.06% had been caught in the wild.

In Makassar, the major concern is that a large number of bird species are traded (37 species), and that 43% of these traded species are protected under both national and international regulations. The majority of animals displayed in the markets were birds, which are sold as pets. This is also observed in other animal markets found everywhere in Indonesia (Sheperd, 2004; Profauna, 2009; Chng et al,. 2015; Chng & Eaton, 2016; Rentschlar et al., 2018). Many Indonesian people, in particular from Java Island, are known to be bird keepers (Profauna, 2009). Bird keeping has become not only a hobby but also a signal of high status for men. Bird keepers are considered to be wealthy and sophisticated (Profauna, 2009; Budiman, 2014; Rentschlar et al., 2018), and this belief appears to be spreading beyond Java Island, including other communities in Indonesia like Bugisnese and Makassarese people, who comprise the majority of population in Makassar. One reason for the abundance of birds in the markets is the ease with which they can be transported, as compared to

other animals. Moreover, birds are usually relatively easily handled or hidden during transport, and are more easily smuggled both within Indonesia and also outside the country (Bashari, 2015).

Prices of wildlife in the markets of Makassar City did not mirror the conservation status or the origins of the species, but tended to follow popular trends in the markets. For example, most song bird species were rated higher than other animals due to the current trend of buying song birds among bird lovers. In line with this, the endemic species black-ringed white-eye bird, (*Zosterops anomalus*) was the least expensive bird sold in the market, although its price is known to increase as the birds start to sing, which creates some concern for the future of populations in the wild. However, prices are also linked to the demand, as indicated by prices for the red-eared slider turtle (*Trachemys scripta elegans*) and the Wallacean Box turtle (*C.a. amboinensis*). Even though the size and price of *C.a. amboinensis* was higher (15 USD) than *T. s. elegans* (3.5-4 USD), the price was not based on the conservation status nor on the rarity of the species found in the markets, but on the higher demand for *T.s. elegans*. The Wallacean box turtle is one of the most expensive reptile species being traded in the markets of Makassar City, but also one of the hardest to be found in the markets (only one individual), suggesting that there might be a significant decline in the population of this species in the wild. Unfortunately, there is currently no data on the distribution of this species in South Sulawesi. In Thailand, the species was known to be abundant between the 1970s and the 1980s, and decreased in the 1990s (Thirakhupt & Van Dijk, 1994). Similar findings have been made by previous studies on this species in Indonesia (Schoppe, 2009; Schoppe & Das, 2011) and other Southeast-Asian countries such as Laos, Vietnam, Bangladesh and Myanmar (Salter, 1993; McCord & Philippen, 1998; Hendrie, 2000; Rashid & Khan, 2000). This highlights an urgent need of effective population monitoring and enforcement of quota setting for harvesting wild population (Lyons & Natusch, 2012). Finally, in this study, the prices of some species with a high conservation status were not disclosed by the sellers. However, it is likely that these prices were higher than those of other species (Harris et al., 2017).

Our study showed that some local markets in Makassar openly displayed species on sale, even if they had a high-priority conservation status. This may reflect weak law enforcement and monitoring system in the city, as this situation is also the case in other wildlife markets in other parts of Indonesia (Shepherd, 2004; Shepherd, 2006; Nijman et al., 2012; Budiman, 2014; Chng & Eaton, 2016). Interestingly, most wildlife/pet sellers seemed to pretend that they did not know the conservation status of the animals being sold (with only 9% of the respondents answering this question, and the rest providing no answer), and claimed that there were no patrol/inspections from the authorities. In contrast, the government and in particular the BBKSDA mentioned that they conduct routine programs aimed to raise awareness on these topics, with a minimum of 10 activities per year aiming to educate market sellers on protected species, on national and international regulations on wildlife trading, and on the impact of wildlife trading on biodiversity and on the community. During the inspections, we further showed that no proof or data were collected to charge wildlife traders. The reason for these actions was mainly lack of awareness by market sellers or ignorance, as in other parts of the country (Shepherd, 2006; Budiman, 2014; Sheherazade & Tsang, 2015).

Another problem is the source of origin of the species being traded in the markets of Makassar. Some of the species have a non-Indonesian origin, and were obtained from other sellers (middlemen) from the western part of Indonesia, who bring them from other countries into the area. The Philippines, for instance, directly contributed to the supply of some animals in the markets of Makassar. According to Bashari (2015), illegal wildlife trade between Indonesia and the Philippines occurs mainly via sea, in particular for parrots, from Talaud (Sulawesi) to Mindanao, due to family relationships between the residents and the proximity of the two islands. The species from the Philippines in this study likely reached Makassar via this route.

According to Rajagukguk (2016), it is essential to evaluate the factors impacting the effectiveness of wildlife regulations in Indonesia, including regulations, number and capacity of law enforcement officers, facilities used by the law enforcement officers, and community awareness. In Makassar, law enforcement efforts must be elevated together with more systematic and scheduled patrols to the markets (Shepherd, 2006), to reduce wildlife trade violations at the market level. The

mismatched of information gathered from the government and wildlife business owners shows the low level of communication between the two sides. Therefore, more structured, systematic and specific target audiences for governmental programs are required to increase the effectiveness of these measures and reduce the decline of protected species. Specific approaches are required to build mutual relationships between wildlife/pet sellers and government officers in order to stimulate trust and create a support system between the two parties.

Finally, collaboration with various stakeholders needs to be strengthened and endorsed, especially between islands, and between Indonesia and the neighbouring countries (Bashari, 2015), in order to detect and reduce smuggling activities. The national regulations/laws need to be revised, to make them more clearly interpretable by all stakeholders and allow the tackling of violations also in this digital era. Other weaknesses highlighted in this study include the lack of staff for conducting educational programs and routine patrols. However, this could be easily tackled by involving other relevant governmental entities. At the same time, more research should be promoted to cover all ecological and biological aspects of the species being traded, to monitor the impact of wildlife trading on the different species, to set quotas for wildlife trading and to identify the species for which conservation measures and targeted interventions should be prioritized.

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Ethical standards: The study has complied and approved by the Hasanuddin University Ethical Clearance Board for involving human as subject of experimentation No. 1725/UN4.14.8/TP.02.02/2019.

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