

Consumption and Trade of Asian Water Monitor, *Varanus salvator* as Reliance on Wildlife for Livelihoods among Rural Communities in North Sumatra, Indonesia

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ABSTRACT

The water monitor, *Varanus salvator* has been exploited for its skin to supply international demands for reptile leather, whereas meat, liver, and fat are consumed locally in some communities in North Sumatra. Demands for skin seems to be paralleled with meat consumption in this province for more than 25 years. We conducted direct interviews with hunters and collecting managers in five abattoirs in five towns in North Sumatra to obtain preliminary data on consumption and trade of Water monitor. Additionally, we explore the association between consumption, trade, and livelihood of rural communities. We found that lizards of all sizes were taken and processed in the abattoirs for skin and meat trade. Consumption of Water monitor meat in North Sumatra is partially driven by a cultural background and has been occurring probably longer than the skin trade for leather industry. We noted that meat of Water monitor also becomes an alternative protein source because of its lower price. In conclusions, benefits of Water monitor harvest are extended across levels of participants in the local trade, including hunters, collectors, and meat consumers. Meat consumption and skin trade are closely linked with one another in North Sumatra; nevertheless sustainability of the trade needs to be evaluated in the near future to predict demands and production capacity.

Keywords: Harvest, incomes, local business, utilisation, wild meat

INTRODUCTION

The Water monitor, *Varanus salvator*, is among generalist reptiles observed to become highly abundant in and around oil palm plantations and has led to the commercial harvest (Luskin *et al.*, 2013). The water monitor is exploited mainly for its skins, in order to supply international demands on reptile leather. International fashion brands seemed to

favour reptile leather in the last few decades for their exotic luxurious look. Reptile skins, including those of the water monitor are therefore valuable raw materials that are readily produced by reptile collectors in abattoirs and may be exchanged for fast cash for hunters. Catch quotas have been set as high as 468,000 animals, while export quotas range from 413,100 to 421,200 sheets of leather since the past 20 years for destination countries in Europe and Asia. The annual quotas are set based on requests by local Nature Conservation Agencies (BKSDA) and decided at national level following discussion and review by related stakeholders, such as NGOs, academics, and CITES Scientific Authority in Indonesia. Indonesian Institute of Sciences (LIPI) as CITES scientific authority in Indonesia is responsible for setting these quotas based on reviews by experts and discussions with Management Authority, i.e. Ministry of Environment and Forestry (KLHK) and business sectors.

As raw skins are supplied to exporters for processing into leather, meat and other body parts of the water monitors are considered as by-products. Meat production is not regulated by the quota system, probably because demands for other body parts of a Water monitor come from local communities. Hunting for wildlife is a traditional practice sustaining rural livelihoods and wild meat consumption seems still firmly rooted in rural cultures worldwide (Pattiselano, 2005; van Vliet *et al.*, 2016), including in North Sumatra, Indonesia. The Batak ethnic group originated in northern Sumatra has been associated with a cultural tradition of “tuak” drinking, during which occasion wild meat was served as complimentary food termed as “tambul” (Ikegawa, 1997; Samosir and Amal, 2016; Sinaga *et al.*, 2019). Therefore, traditional hunting in this region seemed to have been extended into modern practices (Luskin *et al.*, 2013), as demands for monitor lizard skins remain steady for a relatively long term. In this study, we aim to explore the link between meat consumption, skin trade, and livelihoods of rural communities in North Sumatra.

METHODS

We visited five reptile abattoirs in North Sumatra Province, i.e. Tanjung Balai, Kisaran, Rantau Prapat, Inderapura, and Sei Rampah in April and October 2019. These abattoirs are specialized in providing reptile skin and meat, mainly from Water monitors and reticulated pythons, *Malayopython reticulatus*. Data were obtained by means of casual and unguided direct interview with five hunters and managers/owners of the abattoirs. Morphology data of Water monitors were measured directly on location as Snout-Vent length (SVL) and body mass (m). Additionally, we measured the width of Water monitor skin prior to drying under the sun. We analyzed our data using descriptive statistics, described results of interviews and observations, and summarized our findings with illustrations and in tables. We interpreted our results using references from published research.

RESULTS AND DISCUSSION

Harvest Method, Size, and Price of Water Monitor

Water monitors were harvested in a regular basis but mostly during dry season to supply the trades in skin and meat. Regardless of seasons, period of harvests seem to be continuous in all five towns visited in 2019. Hunters set their traps in April 2019 and delivered their catch to a collector we visited in Tanjung Balai. In October 2019, hunters

were still actively trapping and delivered their catch to all five abattoirs targeted in this study. This successful trapping indicates that Water monitors were actively foraging throughout the year. During both dry and rainy seasons in the eastern parts of North Sumatra, temperatures generally remain stable as it lies within the Tropical Rainforest climate and fluctuate between 22-31 °C with 80% humidity. A lower level of monthly rainfall (100-150 mm) than other parts in the province is recorded for these areas (Prasetyo *et al.*, 2018). Therefore, the stable foraging activity for this generalist species may be influenced by constant climatic factors, i.e. small seasonal temperature variation and abundant precipitation throughout the year (Liu *et al.*, 2012). In contrasts, *V. salvator* in areas with larger latitudes such as in Bangladesh appeared to actively forage between June and September, when temperature and rainfall levels are higher, whereas less active in the dry winter between November and December (Rahman *et al.*, 2017).

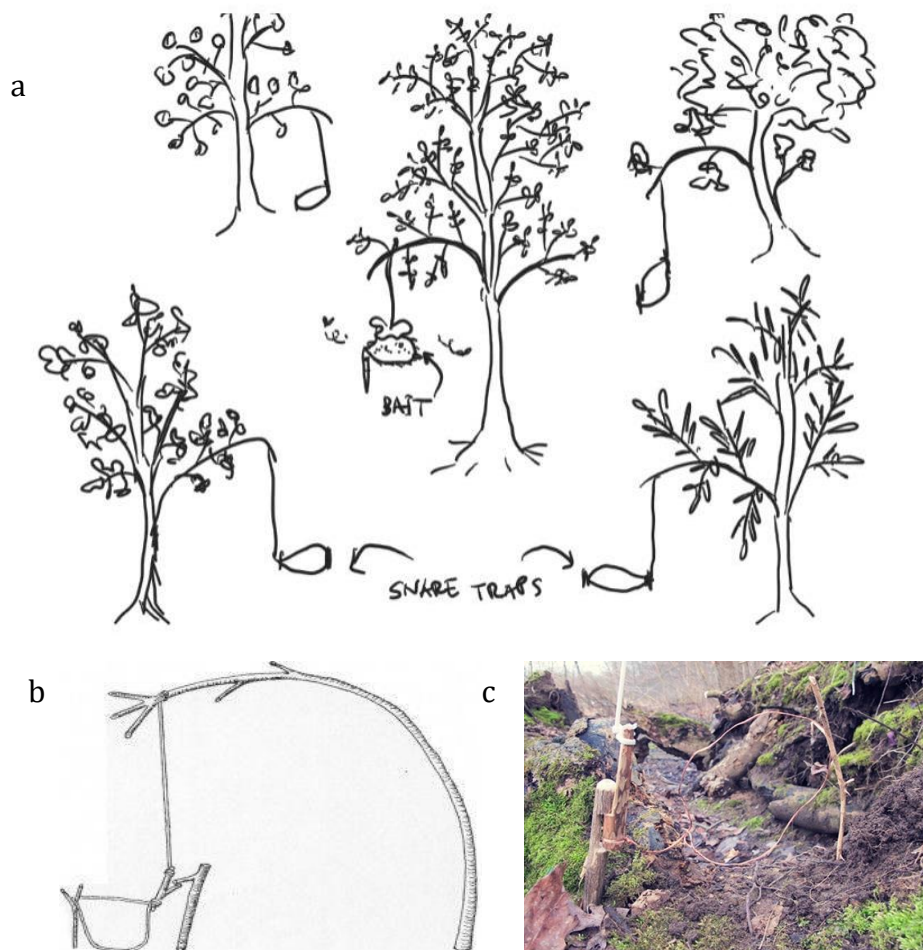


Figure 1. (a) A series of snare traps baited with reptile body parts used collectively to maximise catch of Water monitor in North Sumatra (b) a single snare trap (drawing: refined survival.info) (c) a close-up of a snare trap in use (photo: art of manliness.com)

In Tanjung Balai, hunters' specifically using baited snare traps once or twice a week. The traps were set in a series of ten (10) with baits obtained from abattoirs such as tails, legs, and inner organs of monitor lizards and pythons that are otherwise wastes (Figure 1). Hunters set 9-10 baits of 10 snare traps each in nearby plantations and wait for 2-3 days before checking their traps for captures. Lizards were captured alive and immediately transported to collectors' temporary holding facility before further processing. In one harvest time, 10-32

individual lizards or equivalent to 20-65 kg meat were stocked at collectors' place alive and only slaughtered when buyers order for meat. Thus, buyers prefer meat from freshly killed lizards. During rainy season, hunters used "pengilar", a type of fish traps; however this method and the wet season are not preferred for reasons of time spent for hunting and other costs related to resources such as availability of helpers. Snare-trapping is a common method among wildlife hunters in many parts of the world and it allows the hunter to occupy other activities while maintaining a chance of capture (Dobson *et al.*, 2019).

There is a tendency towards adult medium-sized lizards being delivered by hunters in Tanjung Balai. Reptile collectors in North Sumatra are able to identify demands of Water monitor meat and supply these demands out of harvested lizards that are also valuable for their skin. Live lizards of 3 kg total mass would be sold as meat of 2 kg with a price of IDR 8,000 per kilogram. In Inderapura, price per kilogram Water monitor meat is IDR 10,000, which is also the price of Water monitor meat in Pontianak, West Kalimantan (Mirdat *et al.*, 2019). Lizards with body mass of more than 10 kg were less valuable for fast cash because their skin is difficult to process for leather in tanneries. Skins were measured for its width as one of the requirements for determining its price. Wet skins were set by nailing them down on a wooden board before drying under the sun (Figure 2a).



Figure 2. (a) a set of Water monitor skins on a wooden board using nails (b) We measured the width of Water monitor skin before being set for drying

In April 2019, we noticed lizards of different sizes were ready for sale in Tanjung Balai. Lizard body size range from SVL = 40.00 cm to 83.0 cm ($x = 56.60 \text{ cm} \pm 13.93$, $n=10$) with body mass range from 0.50 kg to 11.50 kg ($x = 4.35 \text{ kg} \pm 3.28$, $n=10$). We also checked for skin sizes by measuring their width before being set on a wooden board (Figure 2b). Skin width range from 27.00 cm to 36.00 cm ($x = 31.48 \text{ cm} \pm 2.50$, $n=21$). In October 2019, we observed lizards of various sizes in the abattoir in Inderapura ranging from SVL = 44.00 to 70.00 cm ($x = 51.91 \text{ cm} \pm 8.01$, $n=22$) with body mass range from 1.40 kg to 6.60 kg ($x = 2.36 \text{ kg} \pm 1.22$, $n=22$). Skin width of these lizards range from 18.00 cm to 36.00 cm ($x = 26.04 \text{ cm} \pm 4.39$, $n=22$).

We have the impression that only lizards of adult size were taken and processed in the abattoirs, although there is no regulation on body size limit for commercial harvest of Water monitor in Indonesia. Lizards of approximate SVL of 40.00 cm (males) and 48.00 cm (females) are mature individuals capable of reproduction (Shine *et al.*, 1998), therefore immature individuals did not seem to be harvested. Unless we know the sex of these lizards individually, we cannot estimate the reproductive status of these harvests. Figure 3 illustrates the different sizes of Water monitor taken in an abattoir.



Figure 3. (a) Various sizes of Water monitor before skinning (b) Skinned lizards for subsistence and sale

Parallel Demands for Meat and Skins

Demands for meat come from local traditional taverns called “lapo” as well as families of Chinese and Batak ethnicities around the abattoirs. However, these ethnics are not the only ones to consume Water monitor meat. Some local residents in Sei Rampah of Javanese ethnicity occasionally consume parts of Water monitor, including fat and liver. Meat of Water monitor is considerably cheaper than farmed chicken and the taste is considered similar to that of chicken. Meat from one individual Water monitor of medium size, i.e. 2-3 kg may cost IDR 16,000-24,000, whereas meat from one individual farmed chicken can cost IDR 40,000 (IDR 30,000 per kilogram). Demands also come from Pematang Siantar, the second largest town in North Sumatra that lies about 125 km from the capital city of Medan. About 50-70 kg meat is regularly sent to Pematang Siantar per week for later distributions to lapos and private households.

A Batak family in Kisaran bought two kg of fresh meat of Water monitor for IDR 20,000 from a local reptile collector once or twice a week. This calculation is more economical, for example for a typical family of four with a single income of an oil palm fruit picker. Income for oil plantation workers such as a fruit picker is low, as they are paid for only IDR 60,000 or US\$ 4-5 per visit. Thus, meat of Water monitor seems to be a good alternative for such a low-income family to maintain protein supply. Similar price was

recorded in Pontianak, West Kalimantan (Mirdat *et al.*, 2019); however the price is probably higher across the border in Sarawak (Malaysian Borneo) for MYR 18 or IDR 36,000 (Kirupaliny and Azlan, 2012). Our finding is consistent with previous study on consumption of wildlife meats in Papua, where bush meat is cheaper and readily available in rural areas than meat from farmed animals (Pattiselano *et al.*, 2019). However, wildlife meat consumption in Papua tends to be of traditional subsistence than for commercial purposes (Weyah *et al.*, 2018).

Interestingly, water monitor meat seems to be regarded as delicacy in North Sulawesi as the price per kilogram can be six times higher than those in North Sumatra and West Kalimantan (Table 1). The relatively low price of Water monitor meat in North Sumatra is probably due to the high demand on skin for leather industry, while meat is a by-product of this demand. Likewise, demand of skin from West Kalimantan is as high and meat is consumed by some local communities this province, for example the Dayak tribes. Annual harvest quota for Water monitors in North Sumatra and West Kalimantan is 69,000 and 60,000, respectively in the past five years. In contrast, Water monitor meat is on demand in North Sulawesi, whereas skin is not allocated for harvest quota because of quality consideration (KSDAE, 2020).

Table 1. Known prices of Water monitor meat and other wild meats in Indonesia

Species	Price per kg (Thousand IDR)				
	North Sumatra	West Kalimantan	North Sulawesi	West Papua	Maluku
Water monitor, <i>Varanus salvator</i>	¹ 8-10	³ 10	⁴ 65	-	
Mangrove monitor, <i>Varanus jobiensis</i>	-	-	-	⁶ 35 /head	
Reticulated python, <i>Malayopython reticulatus</i>	² 20		⁴ 50		
Pythons (other species)				⁶ 208 /head	
Cobras e.g <i>Naja sp.</i>		³ 45			
Softshell turtles e.g <i>Dogania sp.</i>		³ 70			
Flying foxes e.g <i>Pteropus alecto</i> , <i>Acerodon celebensis</i>			⁵ 7.5-45 /head	⁶ 27 /head	
Rats e.g <i>Paruromys dominator</i>			⁴ 15 /head		
Wild pig e.g <i>Sus scrofa</i> , <i>Sus celebensis</i>		³ 70	⁴ 35		
Cuscus e.g <i>Phalanger ornatus</i>				⁶ 54 /head	⁷ 30-50 /head

Sources: ¹This study, ²Munte (2019), ³Mirdat *et al.* (2019), ⁴Taogan *et al.* (2020), ⁵Shehezarade and Tsang (2015), ⁶Pangau-Adam *et al.* (2012), ⁷Kusumaningrum *et al.* (2018)

Cooking Methods for Water Monitor Meat

We observed the local methods to prepare meat and identified the resulting three different types of dish, namely curry, soup, and deep-fried meat. A Batak woman in Inderapura who owns a local pub bought 10 kg Water monitor meat and prepared for a curry dish (Figure 4) to complement the consumption of traditional alcoholic drink called “tuak”. Demands of Water monitor from Lapos may reach 20 kg per day; however orders only come after 2-3 days in a week. The dish was cooked with various spices, including “andaliman”, shallots, garlic, ginger, onion spring, kaffir lime leaves, chilies, and pepper. The dish was salty, which was deliberate so that customers will buy more drinks in the pub. One portion of curried Water monitor meat costs IDR 20,000. Similarly, the Dayaks in West Kalimantan also consume Water monitor meat sold in local wildlife restaurants called “Amboyo”, where it is usually prepared in two types of dish, i.e. clear soup and spicy stew termed as “rica-rica” (Mirdat *et al.*, 2019).



Figure 4. A bowl of curried Water monitor meat as a complimentary dish for “tuak” drinking in Lapos in North Sumatra

The Javanese family in Sei Rampah cooked vegetable soup with pieces of Water monitor meat and fat in it (Figure 5a). The soup was served with rice and condiment of thick soy sauce and sliced chilies. In addition, the family also served deep-fried Water monitor meat and liver. Without the bones being removed, the meat as well as liver were spiced with garlic and pepper and seasoned with salt before deep-frying in hot oil (Figure 5b). The two simple dishes were part of occasional meals for this family running a small abattoir. Previous study reported that Water monitor meat was part of an occasional dish on Java because of its novelty as food item and a belief in its health benefits (Nijman, 2016). Preparation methods include grilling as “sate”, cooking with a lot of chili in a manner similar to sautee, which is termed as “pedesan”, and cooking with thick sweet soy sauce, which is termed as “semur” (Uyeda *et al.*, 2014; personal observation).

Consumption of Water Monitor Meat as Traditional Custom

Although the commercial harvest of *V. salvator* for meat and skin has taken place in North Sumatera for at least thirty years, managers of abattoirs do not take note of their meat

and skin production. Our hunter interviewees mentioned that they have actively hunted for Water monitors for commercial purposes since the beginning of 1990s. During this period of thirty years, they never found difficulty finding the animals in their neighboring areas such as plantations and wetlands. Some of these abattoirs even now have been passed on to run by the younger generation in the family such as sons and nephews. Thus, the trade of Water monitors has been a family business that seems to be a source of stable income for relatively long time.



Figure 5. Water monitor meat, fat, and liver prepared by a Javanese family: soup (left) and deep-fired (right)

Meat, fat, and liver of Water monitor sometimes regarded as delicacy but some families in the rural communities in North Sumatra consider Water monitors as dirty for being a scavenger species. Religious beliefs seem to also prevent consumption of Water monitors, for example the Muslims in West Java, who would not eat Water monitors for it is a carnivorous terrestrial animal (Nijman, 2016). Previous research in Vietnam, Nepal, and India found that meat of monitor lizards are consumed by people with high income or regarded as treat (Ghimire *et al.*, 2014; Sandalj *et al.*, 2016; Bhattacharya and Koch, 2018). In these countries, religious beliefs of most of the inhabitants do not seem to outlaw consumption of monitor lizards.

While it is common in rural areas and towns in South and Southeast Asia for local communities to consume meat of monitor lizards, such as in Colombo in Sri Lanka (Hidelaratchi *et al.*, 2010), Karachi and Thatta in Pakistan (Hashmi *et al.*, 2013), Parasan in Nepal (Ghimire *et al.*, 2014), Hue in Vietnam (Sandalj *et al.*, 2016), Chak Manik (West Bengal) in India (Bhattacharya and Koch, 2018), and Pontianak in Indonesia (Mirdat *et al.*, 2019), little is being published on cases of diseases or parasitism related to the consumption of wild monitor lizard species (Magnino *et al.*, 2009; Hidelaratchi *et al.* 2010).

Consumption of Water monitor meat in North Sumatra seems to be concentrated in the town of Pematang Siantar, where reptile meat may be found in “kedai nasi” or a type of local small restaurant. The majority of population in this town is Simalungun, which is a sub-ethnic of Batak and Christians. A woman who owns a “kedai nasi” has been serving Water monitor and python meats for 25 years. These meats are believed to be beneficial for health, for example to cure asthma and to reduce cholesterol level (Munte, 2019). Other communities in North Sumatra known to consume Water monitor meat include those in the regencies of Humbang Hasundutan (Sihombing, 2018) and Langkat (Fentina, 2019). However this cultural

custom is likely to occur in wider communities in North Sumatra, as wide as the “tuak” culture is being practiced, for example in the areas of Batak settlements in Deli Serdang, Asahan, Karo, around the Lake Toba, Tapanuli, Natal, and up to the border with West Sumatra (Antono, 2005).

Apparently common in rural areas, meat of Water monitor is also consumed in urban communities such as in the town of Pematang Siantar, in which religious rules do not exclude the practice. Water monitor meat has been consumed much longer than the trade of this species for leather industry, probably since the mid-1800s, when Batak societies established their permanent settlements and agricultural lands (Andaya, 2002). Water monitor is also a part of the artifacts found in a cave in northeastern Sumatra, suggesting consumption of the meat by early human beings during the early Holocene (Wiradnyana, 2009). In this case, Water monitor is a primitive choice for source of animal protein that is still being passed on to the most recent generation of people in North Sumatra.

Extension of Tradition, to What Level of Sustainability?

As meat consumption is being facilitated by growing skin trade in the past 30 years, sustainability of the meat and skin trades remains to be reviewed since it was last done in the late 1990s (Shine *et al.*, 1998). Evidence shows that the trade is continuing since thirty years ago and Water monitor meat is still on demand. We consider consumption of Water monitor meat in North Sumatra is partly driven by culture, for example within the non-Muslim Bataks and Chinese societies. On the other hand, meat of Water monitor becomes an alternative of protein source because of its lower price due to the continuing demand on skins. Wild meat such as Water monitor is not a treat for those with low income but a cheaper alternative of animal protein source as well as a product to trade for short-term allowance (Robinson and Bennett, 2002). Because benefits of wild collection are spread across levels of trade participants, i.e. hunters, collectors, meat consumers, to leather exporters, a decline in demands may accordingly impact the people at all these levels. However, it remains unclear whether the level of meat consumption and cultural habit is driven by skin trade or independent from the demand on skins for leather industry.

CONCLUSIONS

Consumption of wild meat such as that of Water monitors is being practiced in some rural communities in North Sumatra as cultural habit. At the same time, meat of Water monitor is a by-product of skin trade for leather industry that has been occurring since at least 25-30 years ago. The trade benefits not only exporters and collectors but also hunters for extra income and some communities for alternative source of animal protein. As wild meat consumption and skin trade are associated closely with one another, sustainability of the trade needs to be assessed in the near future. Because rural communities rely on skin and meat trade for their livelihoods for a longer term now, a decline on demands for these wildlife product may affect their economics considerably. In fact, lizards of various sizes have been taken regularly and yet demands for both meat and skin do not seem to halt after three decades or so. Therefore, an evaluation on the trade should aim to predict demands and production capacity in the longer term.

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REFERENCES

- Andaya, L.Y. 2002. The trans-sumatra trade and the ethnicization of the 'Batak'. *Bijdragen tot de Taal-, Land-en Volkenkunde* 158(3): 367–409.
- Antono, Y.S. 2005. Rumah tradisional Batak Toba menuju kepunahan: suatu analisis antropologis. *Logos Jurnal Filsafat-Teologi* 4(2): 107–133.
- Bhattacharya, S. and Koch, A. 2018. Effects of traditional beliefs leading to conservation of water monitor lizards (*Varanus salvator*) and threatened marshlands in West Bengal, India. *Herpetological Conservation and Biology* 13(2): 408–414.
- Dobson, A.D., Milner-Gulland, E.J., Ingram, D.J. and Keane, A. 2019. A framework for assessing impacts of wild meat hunting practices in the tropics. *Human Ecology* 47(3): 449–464.
- Fentiana, N. 2019. Kebiasaan mengkonsumsi tuak dan persepsi sehat masyarakat Desa Bukit Selamat Kecamatan Besitang Kabupaten Langkat Propinsi Sumatera Utara. *Jurnal Ilmiah Universitas Batanghari Jambi* 19(3): 620–622.
- Ghimire, H.R., Phuyal, S. and Shah, K.B. 2014. Protected species outside the protected areas: people's attitude, threats and conservation of the Yellow Monitor (*Varanus flavescens*) in the Far-western Lowlands of Nepal. *Journal for Nature Conservation* 22(6): 497–503.
- Hashmi, M.U.A., Khan, M.Z. and Amtyaz, N.U.H. 2013. Current status, distribution and threats of *Varanus* species (*Varanus bengalensis* and *Varanus griseus*) in Karachi and Thatta of Sindh. *International Journal of Fauna and Biological Studies* 1(1): 34–38.
- Hidelaratchi, M.D.P., Riffisy, M.T.M. and Wijesekera, J.C. 2010. A case of eosinophilic meningitis following monitor lizard meat consumption, exacerbated by anthelmintics. *Ceylon Medical Journal* 50(2): 84–86.
- Kirupaliny, S.B. and Mohd-Azlan, J. 2012. Wildlife utilization survey in selected areas of Sarawak. *Proceeding of the 4th Regional Conference on Natural Resources in the Tropics (NTrop4)*: 256–261.
- KSDAE. 2020. Kuota pengambilan tumbuhan alam dan penangkaran satwa liar 2020. Downloaded from www.ksdae.menlhk.go.id on April 27th, 2020.
- Kusumaningrum, E.N., Supriatna, J., Abinawanto, A. and Bowolaksono, A. 2018. Ethnozoology–The perception of Tobelo Dalam tribal community in Saolat Village, East Halmahera, Indonesia towards cuscus (Phalangeridae). *Biodiversitas Journal of Biological Diversity* 19(6): 2140–2146.
- Liu, Z., Wang, H., Hantoro, W.S., Sathiamurthy, E., Colin, C., Zhao, Y. and Li, J. 2012. Climatic and tectonic controls on chemical weathering in tropical Southeast Asia (Malay Peninsula, Borneo, and Sumatra). *Chemical Geology* 291: 1–12.

- Luskin, M.S., Christina, E.D., Kelley, L.C. and Potts, M.D. 2013. Modern hunting practices and wild meat trade in the oil palm plantation-dominated landscapes of Sumatra, Indonesia. *Human Ecology* 42(1): 35–45.
- Magnino, S., Colin, P., Dei-Cas, E., Madsen, M., McLauchlin, J., Nöckler, K., Maradona, M.P., Tsigarida, E., Vanopdenbosch, E. and van Peteghem, C. 2009. Biological risks associated with consumption of reptile products. *International Journal of Food Microbiology* 134(3):163–175.
- Mirdat, I. Kartikawati, S.M. and Siahaan, S. 2019. Jenis satwa liar yang diperdagangkan sebagai bahan pangan di Kota Pontianak. *Jurnal Hutan Lestari* 7(1): 287–295.
- Munte, T. 2019. Cerita penjual daging dan sup ular di Siantar <https://www.tagar.id/cerita-penjual-daging-dan-sup-ular-di-siantar>
- Nijman, V. 2016. Perceptions of Sundanese men towards the consumption of water monitor lizard meat in West Java, Indonesia. *Biawak* 10(1): 22–25.
- Pangau-Adam, M. and Noske, R. 2010. Wildlife hunting and bird trade in northern Papua (Irian Jaya), Indonesia. *In* S. Tidemann and A. Gosler (eds). 2010. *Birds: Hunting and Products*. Earthscan Publication Ltd, London and Sterling, VA. 73-85 p.
- Pangau-Adam, M., Noske, R. and Muehlenberg, M. 2012. Wildmeat or bushmeat? Subsistence hunting and commercial harvesting in Papua (West New Guinea), Indonesia. *Human Ecology* 40(4): 611–621.
- Pattiselanno, F. 2005. Animal protein in the pot: the ethnozoology perspective of native Papuans. *Journal of Tropical Ethnobiology* 2(2): 62–69.
- Pattiselanno, F., Apituley, J.R., Arobaya, A.Y. and Koibur, J.F. 2019. Using wildlife for local livelihood—Experiences from the Bird's Head Peninsula, West Papua, Indonesia. *Biodiversitas Journal of Biological Diversity* 20(7): 1839–1845.
- Prasetyo, B., Irwandi, H. and Puspardini, N. 2018. Karakteristik curah hujan berdasarkan ragam topografi di Sumatera Utara. *Jurnal Sains dan Teknologi Modifikasi Cuaca* 19(1): 11–20.
- Uyeda, L., Iskandar, E., Purbatrapisila, A., Pamungkas, J., Wirsing, A. and Kyes, R. 2014. Water monitor lizard (*Varanus salvator*) satay: A treatment for skin ailments in Muarabinuangun and Cisihi, Indonesia. *Biawak* 8(1): 35–38.
- van Vliet, N., Cornelis, D., Beck, H., Lindsey, P., Nasi, R., LeBel, S., Moreno, J., Fragoso, J. and Jori, F. 2016. Meat from the wild: extractive uses of wildlife and alternatives for sustainability. *In* R. Mateo, B. Arroyo, J. T. Garcia (eds). 2016. *Current Trends in Wildlife Research*. Springer, Cham. 225–265 p.
- Rahman, K.M., Rakhimov, I.I. and Khan, M.M.H. 2017. Activity budgets and dietary investigations of *Varanus salvator* (Reptilia: Varanidae) in Karamjal ecotourism spot of Bangladesh Sundarbans mangrove forest. *Basic and Applied Herpetology* 31:45–56.
- Robinson, J.G. and Bennett, E.L. 2002. Will alleviating poverty solve the bushmeat crisis?. *Oryx* 36(4): 332–332.
- Samosir, S.L. and Amal, B.K. 2016. "*Lapo tuak*" sebagai ruang publik perspektif Jurgen Habermas. Penerbit Yayasan Al-Hayat, Universitas Negeri Medan, Medan. 90 p.
- Sandalj, M., Treydte, A.C. and Ziegler, S. 2016. Is wild meat luxury? Quantifying wild meat demand and availability in Hue, Vietnam. *Biological Conservation* 194: 105–112.
- Sheherazade, S. and Tsang, S.M. 2015. Quantifying the bat bushmeat trade in North Sulawesi, Indonesia, with suggestions for conservation action. *Global Ecology and Conservation* 3: 324–330.
- Shine, R. and Harlow, P.S. 1998. Ecological traits of commercially harvested water monitors, *Varanus salvator*, in northern Sumatra. *Wildlife Research* 25(4): 437–447.

- Sihombing, E.D. 2018. *Gambaran kebiasaan konsumsi tuak, pola makan dan keluhan gejala gastritis pria dewasa di Desa Sibuntuon Partur Kecamatan Lintongnihuta tahun 2018*. Unpublished thesis. Universitas Sumatera Utara, Medan. 100 p.
- Sinaga, S.Y. and Salim, T.A. 2019. Knowledge preservation of tuak as Batak Toba social community culture. *International Review of Humanities Studies* 4(1): 415–419.
- Taogan, S., Kainde, R.P. and Tasirin, J.S. 2020. Perdagangan jenis satwa liar di Pasar Langowan, Sulawesi Utara. *Cocos Jurnal Ilmiah Fakultas Pertanian Universitas Sam Ratulangi* 1(2): 1–11.
- Weyah, W., Keiluhu, H.J. and Karim, A.K. 2018. Wildlife use in Lapua community of Kaureh, Papua. *Jurnal Biologi Udayana* 22(2): 51–58.
- Wiradnyana, K. 2009. Sistem pangan pendukung budaya Hoabinh. *In* Susilowati, N., Soedewo, E., Koestoro, L.P. (eds.). 2009. *Jejak Pangan dalam Arkeologi. Seri Warisan Budaya Sumatera Bagian Utara No. 0409*. Balai Arkeologi, Medan. 55–70 p.

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