The impact of Traditional Asian Medicine on African wildlife:

the role of East Asian immigrants

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Abstract

The variety of wildlife products used in Traditional Asian Medicine (TAM) is extensive and includes many species that have been designated as threatened according to the IUCN Red List criteria. However, the role of TAM in global health care has been recognised by the World Health Organisation and TAM practices are predicted to increase globally. In 2013, China announced its ambitious Belt and Road Initiative (BRI) to increase China's involvement in international development, covering 65 countries. The expansion of BRI, with promotion of TAM as a key tenant, increases trade connectivity between Africa and China may create an opportunity for wildlife trafficking, particularly for high value wildlife products such as those used in TAM. This research aims to explore TAM practitioners' and consumers' knowledge and preference in South Africa towards the use of wildlife parts; determine how it might contribute to the illegal trade and consumption at national and international levels; and determine which factors influence choice of treatment. Market surveys were conducted to evaluate the scale of the markets, social surveys undertaken to examine the trade and demand between South Africa and Vietnam, and a specialized questioning technique used to estimate the use of endangered wild animal species in TAM. Three main groups of TAM consumers were identified in South Africa: the new Asian migrants, the Chinese African and the local African. There is a strong belief ingrained in TAM users in the power of consuming wild animal parts as medicine across all consumer groups. Our findings suggest that the practice of TAM, including the use of wild animal parts is established among the local African peoples, beyond the Asian diaspora. There were a considerable number of wild animal parts being sold for TAM purposes in South Africa, including raw parts from Asian species such as bear bile and gallbladder, and processed products that have been manufactured within Asia and potentially smuggled into South Africa for domestic consumption. Together, these findings enhance our knowledge regarding the illegal trade and consumption of wild animal parts for TAM in South Africa, and highlighted the need for collaboration efforts between organisations and relevant stakeholders to tackle these issues.

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Chapter 1

Introduction

1.1 Global trade of wildlife

Biodiversity provides humans with economic benefits and ecosystem services (Singh, 2002). However, these benefits are not always apparent or appreciated. Over the past 50 years, human overpopulation and overconsumption have cause more rapid biodiversity loss and changes in the fragile ecosystem than ever recorded in our history, leading to the sixth mass extinction event (Barnosky et al., 2011; Ceballos et al., 2015).

Natural resources, including plants and animals are harvested for multiple different purposes, including food, fuel, medicines, trophies, materials for construction and others. With increasing globalisation, a large proportion of this harvest is being traded across international borders to supply a growing global demand. The legal wildlife trade is regulated by The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) to ensure legality, sustainability and traceability (CITES, 2020). The illegal wildlife trade, on another hand, is non-regulated and is a serious conservation problem, causing a major threat to the survival of many fauna and flora species (Izzo, 2010). While the legal wildlife trade supports millions of people worldwide (Engler and Parry-Jones, 2007; Symes et al., 2018), a significant portion of trade in wildlife is illegal. This illegal trade represents the significant threat to global biodiversity. The illegal trade of wildlife is recognised as one of the world's largest forms of transnational crimes, worth approximately 19 – 25 billion USD per year, only outranked by narcotics, counterfeiting and human trafficking (Haken, 2011). Approximately 7,000 species of plants and animals have been reported in global seizure data, with timber being the most widely traded wildlife commodity by both volume and value (UNODC, 2016).

Exploitation is one of the major threats to mammal species, with almost a quarter of the world's

5,488 known species affected (Vie et al., 2009). While the trade in elephant ivory, rhino horn and tiger

parts are regarded as high profiles and have received much attention from the public, the illegal wildlife

trade also affects less charismatic species, from animals such as birds, fishes, tortoises to plants such as

cycads and many others (Brashares et al., 2004; Cinner et al., 2013; Grogan et al., 2010; Lenzen et al.,

2012; O'Brien et al., 2003; van Balen et al., 2000; Williamson et al., 2016). The illegal wildlife trade not

only degrades biodiversity and damages the ecosystem, it also facilitates the transmission of zoonoses

(disease transmitted from animals to humans, e.g. SARS) (Marano et al., 2007), contributes to the

spread of invasive species (Garcia-Diaz et al., 2015; Masin et al., 2014; Su et al., 2015) and threatens

national and international security (Duffy et al., 2015; Roe et al., 2015).

The illegal wildlife trade is highly profitable, with low risk of detection, low penalties and

facilitated by global online trade and transaction (Broad et al., 2003; Ehrenfeld, 2005; Lavorgna, 2014).

In addition, due to the militarization of conservation bodies to combat poaching, especially in Africa, the

illegal wildlife trade has received much attention from governments' worldwide (Roe et al., 2014). In

2014, the UK government took a lead in combating illegal wildlife trade, by hosting the first international

conference on illegal wildlife trade in London. The conference aimed to achieve high level political

commitment to take urgent action to tackle the illegal wildlife trade, through i) strengthening law

enforcement and the criminal justice system, ii) reducing demand for illegal wildlife products and iii)

supporting the development of sustainable livelihoods for communities affected by the illegal wildlife

trade (UK Government, 2014). It was followed by the second and third conferences in Botswana in 2015

and Vietnam in 2016 respectively, attracting over fifty countries and the European Union participated in

both conferences (Wahlen, 2018). Indeed, the illegal wildlife trade has become an important

international policy issue (Duffy, 2016). In 2018, the London Declaration on the Illegal Wildlife Trade

called for governments across the globe to tackle the illegal wildlife trade as a serious and organised crime, fuelled by corruption and money laundering (UK Government Policy Paper, 2018).

Besides government effort, the UK Royal family has also lent their support for endangered wildlife through the establishment of the United for Wildlife project, led by the Duke of Cambridge and the Royal Foundation. United for Wildlife aims to tackle the illegal trade by bringing organisations, governments and other sectors together. The Duke of Cambridge appeared at several high-level conference, such as those in London to address the issues and call for urgent action from governments worldwide (United for Wildlife, 2019). In 2013, celebrity Leonardo DiCaprio and his foundation launched an initiative known has "Hands Off my Parts" with the World Wide Fund for Nature (WWF) to stop wildlife crimes. This campaign highlights what people can do to help, and resulted in the ban on all ivory trade in Thailand (Leonardo DiCaprio Foundation, 2017). Meanwhile, the Clinton Global Initiative (created by the Bill and Hilary Clinton family) launched a new coalition of conservation organisations and African governments collaborating to curb elephant poaching and elephant ivory trafficking (Clinton Global Initiative, 2013).

1.2. The use of wild animals in Traditional Asian Medicines and Traditional African Medicines

Every culture in the world has their own traditional forms of medicine which are often based on their history and beliefs. Due to globalization, many forms of traditional medicines are no longer restricted to a region but are increasingly being transmitted and practiced beyond the traditional region through the movement of diaspora. Demand for traditional medicines is also increasing, as it is often considered to be more person-centred healthcare, compared to 'western' or 'modern' medicine (di Sarsina et al., 2012). Traditional medicines can also bring significant benefits to local economies and human welfare. Traditional Chinese Medicine (TCM) is the oldest form of Traditional Asian Medicine (TAM) and is estimated to be worth 83.1 billion USD in China in 2012 (National Development and

Reform Commission of China, 2013). In a 2009 survey, the number of patients visiting TCM clinics in China accounted for 18% of all medical visits (WHO, 2013). In rural areas of Africa, it was estimated that one traditional healer takes care of up to 500 people, with traditional medicine being the primary form of healthcare for approximately 80% of people in Africa (Awah, 2016; Eddouks, 2012). Not only popular in developing countries, traditional medicine practices are also increasing in the USA, Australia and Europe (WHO, 2013).

Traditional medicines comprise a variety of natural resources, including plants, animals and minerals (Alves and Rosa, 2005; Whiting et al., 2011). Chemicals from animal parts have been extracted for human health care for centuries and are still being used today in modern medicine (Agosta, 1996; Costa-Nero, 2005). Animal products are harvested for traditional medicine in a variety of ways, either through their parts (organs, body parts or excreta) or the structures they make such as nests and cocoons (Costa-Neto, 2005). According to Alves and Rosa (2005), the World Health Organisation recognised 252 essential chemicals used in human medicine, of which 8.7% are derived from animals and 11.1% come from plants. In addition, 27 out of 150 prescription drugs in the USA originated from animals (World Resources Institute 2000). The annual global trade in animal-based medicinal products accounts for billions of US dollars per year (Kunin and Lawton, 1996).

Known as one of the most widely practiced systems in the world, the origin of TAM dates back 3,000 years in China (Park et al., 2012). TAM uses 1,574 animal species as ingredients (Wahlberg, 2016), some of those, such as tiger, rhino, saiga and pangolin, are now threatened with extinction and prohibited from international commercial trade (Liu et al., 2016). Due to the need to protect these species, certain animals and their parts, such as tiger bone and rhino horn, have been removed from the Chinese Pharmacopoeia since 1963 (Chinese Pharmacopoeia Commission, 2010). However, in October 2018, the Chinese government announced the intention to consider legalising rhino horn and tiger bone for use in traditional medicine (Maron, 2018). This announcement received much attention from the

media, conservation bodies and animal activists. Under international pressure, the Chinese government postponed their proposal and currently the consumption of rhino horn and tiger bone are still prohibited (Martina, 2018). However, other products from threatened species, such as pangolin scales are legally traded in China at state hospitals for medication through existing stockpiles maintained by the State Forestry Administration (SFA) (Challender et al., 2014). It was estimated that pangolin scales are available at up to 700 licensed hospitals and 70 medicinal manufactories (Hu, 2006). Annually, around 25,000 kg of pangolin scales are used legally in China for medicinal purposes (Yin and Meng, 2013). However, pangolin scales are considered to be one of the most trafficked wild animal products and it is unclear whether scales that are being used today in China are from the stockpiles managed by SFA or from the illegal traded sources (Challender et al., 2014; Xu et al., 2016).

Farming of wildlife to harvest their parts has often been promoted as a conservation strategy and a potential solution to poaching and ineffective law enforcement (Bulte and Damania, 2005). In general, wildlife farming has been practiced in many countries around the world with a variety of species, from reptiles to mammals. There are examples of wildlife farms success, such as snakes (Aust et al., 2017) and crocodiles (Corey et al., 2017), however commercial farming of certain species, such as bear bile for traditional medicine, has brought a different result. In 1980, China started its commercial bear bile farming which has resulted in at least 10,000 bears being kept in captivity at present. In Vietnam, it was estimated over 4,000 bears were taken from the wild for the national bear bile farming industry (Crudge et al., 2018). Thirteen years after the Vietnamese government banned bear bile extraction, there were still over 1,000 bears in bile farms. In 2017, the Vietnamese government acknowledged that bear bile farming has caused a negative impact on wild bear populations and agreed to end bear bile farming (Crudge et al., 2018). The case of bear bile farming is an example of wildlife farming failing to meet the demand, as consumers prefer to use wild products rather than farmed wildlife products, particularly for Traditional Medicines (Davis et al., 2016; Dutton et al., 2011).

1.3. China's Belt and Road Initiative and the Asian diaspora

China has a historical relationship with Africa, which can be divided into 5 periods according to Antonio and Ma (2015): i) Chinese send aid to Africa in the context of the cold war and Bandung Conference (1955 – 1960); ii) Rivalry between China and Soviet Union in Africa (1960 – 1974); iii) Attempted cooperation between, and subsequent abandonment of Africa by China (1975 – 1989); iv) New Chinese interest in Africa (1989 – 2000); and v) Strategic partnership in Africa (2000 – present). According to the authors, China began investing in strengthening their relationship with African countries when it realised the potential economic returns from investments during the 4th period (1989 – 2000). Since then, China has been promoting cooperation with African enterprises, integrating aid, investment and trade (Yao, 2013). However, Chinese enterprises in Africa are observed to be exclusively using Chinese migrant labour rather than people from local communities (Cook et al., 2016; Isaksson and Kotsadam, 2018). As such, the investment is only having a limited impact in terms of improvement in local livelihoods (White and Alves, 2006).

The Chinese engagement in Africa was purely based on the "hard power" of aid and investment, which has been criticised by the international community (Antonio and Ma, 2015). The 5th period (2000 – present) is important as the Chinese government continues engaging with African countries through the development of new strategies that employ the "soft power" approach and demonstrates a more sustainable relationship between China and Africa (He, 2009; Zhang, 2011). This period marked the development of China's Belt and Road Initiative (BRI) – the largest global infrastructure development program in the world. It is designed to facilitate international trade with China and is core to China's geo-political development strategy. An estimated 4 trillion USD worth of BRI investment is planned across more than 65 countries, including those in Africa (Renwick et al., 2018).

African countries have readily embraced the BRI projects, perceived as a necessary step for economic growth on the continent (Naidoo, 2017). Under the development of BRI, industrial zones known as Special Economic Zones (SEZs) have been established across Africa (Zeng, 2010). South Africa's relative economic strength and pan-African footprint has allowed it to adopt the role of gateway to the African continent for China. South African's foreign policy promotes itself as gatekeeper to the continent through its prominent international standing (Ebrahim, 2017). In May 2018, South Africa secured an investment from China of more than 10 billion USD into the Musina-Makhado SEZ, which is the seventh SEZ within South Africa (Akeredolu, 2018).

Chinese communities in Africa have become a significant part of the growing political, economic and socio-cultural ties between the world's second largest economy and the most underdeveloped continent. The Chinese communities, mainly established by poor Chinese workers and traders hoping to make their fortunes, have settled throughout Africa over the past decades. An estimated one million Chinese are now thought to be living in Africa, including approximately 300,000 – 400,000 in South Africa (Hall, 2013; Kushner, 2013; Park, 2012). Previous research in southern Africa indicates that, although many Chinese migrants plan to eventually return to China, many in South Africa have stayed (Park, 2005; Mohan and Kale, 2007). As such, South Africa is the only African country with fifth generation of Chinese and Taiwanese (Park and Chen, 2009).

There are however growing concerns over the development of BRI and its potential impact on the environment worldwide (Lechner et al., 2018; Ascencao et al., 2018). An example of the negative impact from SEZs is Cambodia, a small country in Southeast Asia, in which China is the largest investor and to which it has become increasingly politically aligned. An increased flow of capital and visitors from mainland China appears to be increasing trade in ivory and other high value wildlife products (Nguyen and Frechette, 2017). In 2017, 1.2 million Chinese tourists visited Cambodia, a 45% increase on numbers from 2016, with the vast majority visiting resorts often developed under the BRI banner (Goh and Thul,

2018). Ivory shops are appearing in such tourist centres and are catering almost exclusively to Chinese visitors, with surveys showing an 11-fold increase in the availability of carved ivory in the coastal resort of Sihanoukville between January 2016 and June 2017 (Nguyen et al., 2018). Recent market research has highlighted that the most significant growing segment of Chinese ivory consumers are those who regularly travel overseas (Nguyen et al., 2018). The recent 70th meeting of the CITES Standing Committee highlighted shortfalls in the implementation of many National Ivory Action Plans (NIAPs), including Cambodia's, which were mandated in response to the elephant poaching crisis in Africa. Most recently, Cambodia seized more than 3 tonnes of elephant ivory originating from Mozambique (Cheslow, 2018). It is noteworthy that China is one of the largest investors in both Cambodia and Mozambique (Nguyen and Frechette, 2017; Roque, 2009). Despite some laudable efforts, Cambodia's inability to effectively implement its NIAP is partly driven by a lack of resources and capacity to respond to the impacts of Chinese investment. Such investment needs to be matched by resources for mitigating impacts, including support for effective enforcement against illegal wildlife trade, which may be a consequence of BRI projects.

China's Belt and Road Initiative
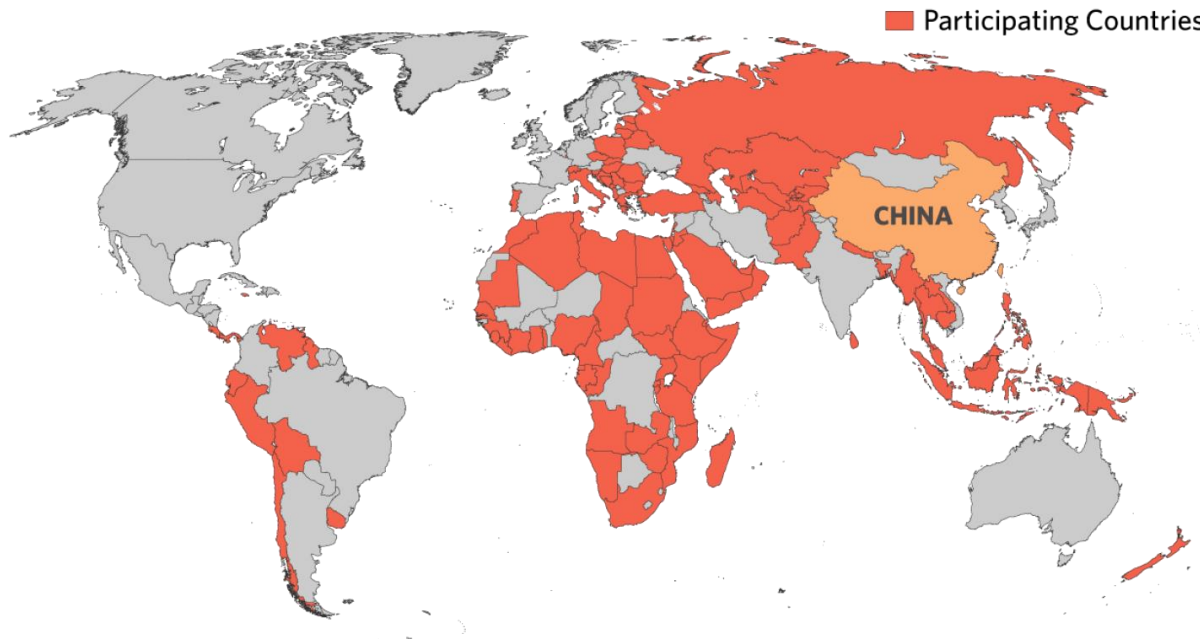
Figure 1.1: Map shows countries that are currently participating in the BRI project. Source: Stratfor 2019.

Reports from South Africa stating Chinese and Vietnamese involvements in illegal wildlife trade and practices, including gill-net fishing; abalone trade, as well as elephant tusk, pangolin and rhino horn smuggling, have accumulated in recent years (Park, 2012; Nyariki, 2013). A report from TRAFFIC - the wildlife trade monitoring network in 2012 showed that from the Asian citizens arrested for rhino crimes in South Africa, 56% were Vietnamese, 28% were Chinese and 31% were Malaysian or Thai (Milliken and Shaw 2012). In 2018, six Vietnamese migrants were arrested in South Africa for illegally possessing lion bones, meat and claws (Vietnam News 2018). In the same year, the Environmental Investigation Agency revealed the increasing number of Vietnamese criminal syndicates involved in wildlife trafficking from Africa, including 59 tonnes of African elephant ivory seized in Vietnam and additional 20 tonnes linked to Vietnam from other countries. In addition, at least 22 shipments of ivory, worth up to 14 million USD,

were successfully transported from Africa, organised by the Vietnamese criminal network between

January 2016 to November 2017 (EIA. 2018).

1.4. Wildlife laws and regulation

Government signatories (including Vietnam and South Africa) to the October 2018 joint

declaration made at the London Illegal Wildlife Trade Conference called "*upon the international*

community to act together to support and build urgent collective action to tackle the illegal wildlife trade

as a serious crime carried out by organised criminals" (UK Government Policy Paper. 2018). Here we

explore both the Vietnamese and South African frameworks to understand how it applies to the illegal

trade and consumption of endangered species, especially those use as ingredients for traditional

medicines.

1.4.1. Summary of the legal framework in Vietnam

Located in Southeast Asia, Vietnam borders Cambodia, Laos, and China as well as being situated

adjacent to the South China Sea. The country has a total area of 331,210 km^2 with a population of over

90 million (CIA World Factbook, 2015). In terms of biodiversity, Vietnam is the 16th most biologically

diverse nation on the planet and is home to several endangered species (Venkataraman, 2007).

According to Ray et al. (2007), during the Vietnam War the US military operations caused extensive

damage to Vietnam's forests, destroying an estimated 20,000 km^2. In addition, the US sprayed an

estimated 72 million litres of herbicides which resulted in 16% of the country being contaminated. As a

consequence of the war and forest destruction due to the Vietnamese government attempts to rebuild

the country, only 20% of Vietnam's forest cover was left by 1995 (Ray et al., 2007).

Vietnam is a one-party socialist country, where the Communist Party plays an important role in

all branches of the government, politics and society. As Vietnam attempts to construct an appropriate

framework for a successful market-based economy, it is increasingly difficult to categorise which legal

system Vietnam belongs to (Do, 2011). There are 25 different types of legal documents in Vietnam, including national level legislation such as the Constitution, Laws, Government Decrees and Decisions of the Prime Minister, as well as Provincial and communal level legislation, such as Resolutions of the People's Council and Decisions of the People's Committees of provinces, districts and communes. The legal framework is composed of legislative documents and also other documents that have not been developed within the legislative process per se but still carry weight in the hierarchy of norms, such as CITES to which the country became a signatory in 1994. In Vietnam, CITES is implemented by Decree 82/2006/ND-CP. This decree sets out several provisions in relation to the import and export of wildlife, applied to all species included in CITES appendix I, II and III, as well as wild fauna and flora in Vietnam. However, this decree does not contain mandatory or recommendation sentences or criteria to apply when crime is detected.

The decree on management of endangered, precious and rare forest plants and animals, known as Decree 32/2006/ND-CP is the most well-known legislation on managing natural resources in Vietnam. This decree makes a distinction between two groups of plant and animals: Group I includes plants and animals that are endangered, precious and rare accordingly to the Vietnamese domestic legislation, and those listed in Appendix I of CITES. Group II are those restricted from exploitation listed in CITES Appendix II and domestic legislation, therefore permits are required for all purpose of use, including commercial, scientific or education.

The Priority Protection Species provides additional lists of species that are endemic, highly threatened in Vietnam in addition to those listed in Decree 32 and CITES Appendices I, II and III. Species that are listed under the Priority Protection Species are protected under Decree 160/2013. Common plants and animals that do not appear on CITES, Decree 32 nor the Priority Protection Species list are regulated for commercial farming purposes.

Under the last few years, Vietnamese government has tightened the law and increased maximum fines violation of highly protected wild animals (i.e. rhino, elephant, tiger, bears) to 2 billion Vietnam Dong (85,490 USD or 67,888 GBP) and up to 15 years imprisonment (Decree 244).

1.4.2. Summary of the legal framework in South Africa

South Africa experiences varied climates, ecosystems and vegetation that play host to some of the most remarkable biodiversity in the world. South Africa is situated on the southern tip of the African continent, covers a total land surface area of 1,219,090 km^2 and its Exclusive Economic Zone in the oceans off its coastline covers an additional area of 1,071,883 km^2 (Lombard et al., 2004). This country is the fourth most linguistically diverse in the world, with 11 official languages recognised. The current population of South Africa is over 58 million people, equivalent to 0.75% of the total world population (Worldometers, 2019).

South Africa is home to over 200 species of mammals, from the African savannah elephants to smaller species such as jackals (Gordon et al., 2019). This country has the highest estimated rate of extinctions for any area in the world (Rademeyer, 2012). South Africa, however, contains the world's largest populations of rhinos (80% of the remaining global population), including 93% (c. 20,000) of the world's southern white rhinos and 40% (c. 2,000) of the world's southern black rhinos (Taylor et al., 2014). While substantial, these populations are threatened by a wildlife crime epidemic, driven by the demand for rhino horn from consumers in China and Vietnam (Milliken and Shaw, 2012).

In South Africa, the National Environmental Management Biodiversity Act (NEMBA) 2004 was set out to govern the protection of the country's natural resources. NEMBA 2004 provides the broad framework for wildlife protection in South Africa, but each of the provinces in the country independently implement the national law with their own legislation. Under NEMBA, the import, export, possession, and breeding or trade of any species listed as a threatened or endangered, or their products,

is allowed as long as a permit is issued for this purpose. This list includes species such as rhinos, elephants, pangolins, lions and leopards. In addition, The Threatened or Protected Species (TOPS) Regulation was implemented in 2007 to provide a national standard for the protection and utilization of listed threatened or protected species in South Africa. South Africa became a member of CITES in 1975 and currently has a comprehensive suite of wildlife legislation (DLA Piper, 2015). The South African Department of Environmental Affairs (DEA) has been the de facto lead agency in developing and driving the country's strategic and policy responses to rhino poaching and organised wildlife crime.

It is important to note that in November 2015, a lawsuit was filed by two game breeders to invalidat South Africa's domestic moratorium on trade in rhino horn (Bale, 2017). In June 2017, the DEA clarified that the commercial international trade in rhino horn remains prohibited. However, the domestic trade ban has been lifted and the domestic trade of rhino horn is allowed with relevant permits within NEMBA's regulations. With the lifting of the domestic ban, the DEA has developed an electronic database to capture extensive details on all individual rhino horns in private and government owned stockpiles and all newly acquired horns. The DEA intends to ensure that every horn is tagged with a microchip, recorded in a national database, which includes measurements of the size, weight and DNA profile to regulate and monitor the trade (DLA Piper, 2015).

All the above laws set forth stringent penalties, including fines and/or imprisonment, for activities such as the illegal hunting, killing, import, export, possession of a threatened or protected species, or related offences concerning false documentation and permits. Over the last few years, the severity of penalty fines for wildlife crimes has increased sharply through amendments to relevant legislation. Fines under the TOPS Regulations reach a maximum of ZAR ten million (USD 833,333 or 550,950 GBP), while other wildlife crime offences can carry jail sentences of five years, or ten years in the case of repeat offenders (DLA Piper, 2015).

1.5. Research rationale

With over 1,000 species impacted, overexploitation (primarily for food or medicine) is one of the most significant threats to mammal species, second only to habitat loss. Although 21% of all mammal species are globally threatened with extinction, a larger proportion (36%) of those species used for food and medicine are threatened (Vie et al., 2009). For thousands of years, Asian societies have treated illness with plants and animal products (Ellis, 2005). Although different countries in Asia developed their individual methods of treating ailments from wildlife, these medical traditions are strongly influenced by the traditional medicine practices of China (Pham et al., 2013).

The variety of wildlife products used in Asia is extensive and includes many species that have been designated as endangered or threatened by the IUCN Red List, such as tiger, leopard, pangolin and rhino (Crudge et al., 2018; Gratwicke et al., 2008; Nowell et al., 2011; Venkataraman, 2007; Wasser and Jiao, 2010). However, the role of TAM in global health care has been recognised by the World Health Organisation and TAM practices is predicted to increase globally (Song et al., 2013; Wang et al., 2013). In 2011, China had signed 86 TAM partnership agreements with over 70 countries, including African countries such as South Africa, Kenya and DR Congo (Fang, 2018; SCIO, 2016). Although plant elements are most commonly used in TAM, wild animal parts are also utilised (Liu et al., 2016). As many people in Africa have a tradition of using animal-based medicine, uptake of wild animal parts used in TAM may be more likely in Africa than in any other continent (FOCAC, 2012).

Currently Africa is considered as a "source" continent – providing wildlife parts to feed the demand of TAMs in Asia. However, with the growing economic ties between Africa and Asia, as well as the increase in Asian immigrants in Africa, this continent might soon turn into an "end user" of wildlife parts for TAMs. Beyond direct threats, the conservation of the African wild animals is also hindered by limited knowledge of the illegal trade and consumption of their parts in South Africa through TAM by

East Asian immigrants. This issue must be evaluated and addressed immediately in order to develop effective management strategies for the long-term conservation of Africa's wildlife.

This thesis will provide an understanding of the domestic demand for protected but popular wild animal parts used in TAM such as rhino horn, pangolin scales, tiger bone, lion bone and bear gall bladder products within South Africa for better management and enforcement of the law.

1.6. Thesis outline

Due to the diverse and complex nature of the consumption of protected wild animal parts in TAM, interdisciplinary and innovative approaches are required to develop a better understanding of its implication and to inform future management. This research aims to explore TAM practitioners and consumers' knowledge and preference towards the use of wildlife parts; determine how it might contribute to the illegal trade and consumption at national and international levels; and determine which factors influence choice of treatment. We focus on TAM products made from rhino, tiger, bear, pangolin and lion, given their endangered status and popularity in TAM (Ellis, 2005). This research is hoped to increase our understanding of how the promotion of TAM around the world, through expansion of the BRI and establishment of local Chinese populations in South Africa, might impact local wildlife. This information is vital for conservation of threatened species and it links to a wider conservation management issue. This thesis comprises of the following chapters, each of which is a research paper for publication.

Chapter 2 takes an in-depth look into the understudied market for endangered wildlife products used in Traditional Asian Medicine (TAM) within South Africa through market surveys at the local African wildlife markets, and interview surveys at Traditional African Medicine (*muthi*) shops and TAM shops. Market surveys were also conducted at TAM shops in Vietnam to determine the similarities and differences between the type of wildlife parts being sold in both markets, their origin, prices and the use

of these parts in TAM. This chapter also explores the use of other survey methods in social science, such as Randomise Response Technique and False Consensus Bias to estimate the prevalence of protected products found.

Chapter 3 explores the similarities and differences between *muthi* and TAM practitioners' values, attitudes, behaviours and knowledge toward the use of wildlife products. This was achieved through surveys with *muthi* (in South Africa) and TAM traders and practitioners in both South Africa and Vietnam, with a focus on the use of products from endangered but commonly found wild animals in TAM, such as rhino horn, pangolin scales, bear bile/gall bladder and tiger/lion bones.

Chapter 4 explores the consumer side of the wildlife parts trade for TAM usage in both South Africa and Vietnam by investigating their knowledge of the use of focus species, their motivation and important aspects concerning their consumption habits. This study uses semi-structured interviews amongst consumers of TAM in South Africa and Vietnam to understand their motivations, attitudes, behaviours and preferences in choosing ingredients used in TAM.

Chapter 5 expands on the previous chapters by comparing consumers' behaviours and attitudes by adopting the Randomised Response Technique and False Consensus Bias to reduce untruthful answers regarding the use of protected wildlife parts in TAM, purpose of purchasing TAM containing the focus species, and frequency of use of these ingredients.

Finally, **Chapter 6** provides a synthesis of the main findings from chapters 2 to 5 and outlines the contribution of this thesis to conservation science, practice and policy. Conclusions and recommendations were made regarding the future of the wildlife trade for TAM usage, the possible impact of BRI projects and Asian diaspora in Africa, and the direction for further research built on the finding of the work presented here.

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Chapter 2

Exploring the Africa-Asia trade nexus for endangered wildlife used in

Traditional Asian Medicine: Interviews with traders in

South Africa and Vietnam

Nguyen, T., Roberts, D.L. Exploring the Africa-Asia trade nexus for endangered wildlife used in

Traditional Asian Medicine: Interviews with traders in South Africa and Vietnam

2.1. Abstract

Many species in Southeast Asia have been over-hunted to supply the demand for Traditional Asian Medicine (TAM) ingredients. As access to their parts become more difficult, consumer demand is shifting to novel substitutes, such as in the use of lion bone instead of tiger bone. Accurate estimation of the level of illegal wildlife trade is therefore important to ensure long term sustainability. However, direct observation may underestimate the scales of the trade, as illegal products may not always be visible at the counter. This study aims to provide an understanding of the current illegal wildlife trade market for TAM purposes, as well as explore the possibility of applying different survey methods in detecting the trade in endangered wildlife parts. We surveyed 183 traditional medicine shops in both South Africa and Vietnam between April – August 2017, using direct observation and specialised questioning techniques (SQTs) to estimate the scale of the wildlife trade for TAM purposes. Our results show that the Randomised Response Technique resulted in highest prevalence estimates for the trade in wild animal parts, while False Consensus Bias does not appear to be effective in this study. It is clear that wild animal parts are not only being trafficked from Africa to Asia for TAM use, but Asian originated products such as bear parts may also being smuggled into South Africa for domestic consumption.

Keywords

Consumption, demand, diaspora, immigrants, illegal wildlife trade, *muthi*, wildlife traders, traditional medicine practitioners

2.2. Introduction

China's ambitious and visionary Belt and Road Initiative (BRI) involves an estimated USD4 trillion

worth of infrastructure investment in 65 countries along the former Silk Road - an ancient trade route -

linking it with a network of countries in Europe, Asia and Africa (Tambo et al., 2019). However, the

potential impact of the BRI on biodiversity cannot be overestimated (Hughes, 2019; Lechner et al., 2018;

Sutherland et al., 2018). Chinese migrants, expatriates and tourists have been documented to have an

impact on the growth of the local wildlife trade markets in a number of countries in Africa (Brennan and

Kalsi, 2015), as well as in Southeast Asia (Lao PDR: Livingstone et al., 2018; Krishnasamy et al., 2018;

Myanmar: Nijman and Shepherd, 2014; Nijman et al., 2016 and Cambodia: Nguyen and Frechette,

2017). Increased connectivity with the Chinese market through Chinese nationals being present as

tourists or through business and development projects, as part of the BRI, could therefore result in an

expanded trade in wildlife.

As the Chinese economy rises, Chinese citizens can increasingly afford to travel to other parts of

the world. According to estimates from the UN World Tourism Organization (UNWTO) in early 2015,

Chinese expenditure in outbound tourism in 2014 was USD165 billion, a 20% increase on 2013 (World

Tourism Organization, 2014). The appreciation of Chinese currency and the depreciation of some African

currencies in recent years have made travelling to Africa more affordable for Chinese tourists (Edinger

and Lu, 2013). The rise of Chinese commercial activities in Africa has allowed the establishment of new

flight routes, such as non-stop flights between Beijing and Johannesburg that was launched in January

2012 by South African Airways.

In recent years, China has become South Africa's largest trading partner with trade between the

two countries estimated to be worth R14.7bn (approximately USD1 billion) (Mona, 2018). In South

Africa, the Special Economic Zones (SEZ) programme was started in 2007 and since then 7 SEZs have

been created, including those in Gauteng (Johannesburg) and Durban. SEZ's are geographical areas that have economic laws different from a country's typical economic laws, with the goal of increasing foreign investment and boosting the country's gross domestic production (Akeredolu, 2018). In South Africa, there is a plan to expand the current SEZs, with the establishment of a further 6 SEZs in the coming years (SA Minister of Trade and Industry, 2018). In the Southeast Asian region, the SEZ in the golden triangle (between Laos, Thailand and Myanmar) has been identified as a wildlife trade hub, where parts of highly threatened species, such as bear and tiger, are being sold openly to consumers as luxury products and as ingredients for Traditional Asian Medicine (TAM) (Krishnasamy et al., 2018; Tan, 2012). The establishment of SEZs across Africa and especially in South Africa, with high numbers of workers from China and Southeast Asia, may therefore pose a serious threat to the local African wildlife.

The consumption of endangered animal parts for TAM has been identified as one of the main drivers for wildlife trafficking globally (Craig et al., 2009). The variety of wildlife products used in TAM is extensive and includes many species that have been designated as threatened by the IUCN Red List (Gratwicke et al., 2008; Nowell et al., 2011; Wasser and Jiao, 2010). Species in Southeast Asia that have been extirpated from the vast majority of their former range due to over-hunting to supply the demand for TAM ingredients include the Indochinese tiger (Stoner and Pervushina, 2012), the Sumatran and Javan rhinos (Brook et al., 2014; Kretzschmar et al., 2016). As access to their parts become more difficult, due to increased rarity and expense or improved law enforcement, consumer demand is shifting to novel alternatives, as seen by the increase in lion bone being traded from Africa to Asia as a substitute for farmed tiger bone (Williams et al., 2017), and the poaching of African rhinos to satisfy an increase in demand for rhino horn in Vietnam and China where rhinos are now extirpated (Brook et al., 2014; Milliken and Shaw, 2012). In addition, Vietnam has long been identified as a major consumer market for wildlife and wildlife products, and in recent years there has been a sharp increase in the

volume of shipments from Africa being seized, particularly African rhino horn and pangolin scales (Heinrich et al., 2016; Nguyen et al., 2018).

Direct observation is often used to detect frequencies of wild animal parts being sold illegally in the market (Nijman and Shepherd. 2015; Nguyen and Frechette, 2017). However, detectability should be considered, as illegal products might not always be visible at the counter, and sales may become more covert over time (Barber-Meyer, 2010). Interview surveys therefore provide a useful method to complement direct observations. A number of methods have been developed to allow researchers to ask questions around sensitive topics. These methods provide respondents with additional privacy, as the truthfulness of the answers is unknown to the interviewer, thereby reducing response bias (St John et al., 2012). This is achieved by using a randomising device (e.g. a die) to integrate an element probability in the question-answer process (Lensvelt-Mulders et al., 2005). These methods include the Randomised Response Technique (RRT), crosswise, horizontal and parallel (Heijri et al., 2013; Jann et al., 2012; Korndorfer et al., 2014; Liu and Tian, 2014). RRT in particular has been widely use and including in the estimation of prevalence in illegal product usage (St John et al., 2012; St John et al., 2015). Other methods do not require participants to use a randomising device, these include the Unmatched Count Technique (UCT) and False Consensus Bias (FCB); these have also been successfully applied to address conservation questions (Nuno et al., 2013; St John et al., 2012). FCB operates on a theory that people who conduct certain behaviours tend to believe that others are more likely to behave in the same manner, therefore the respondents give a higher estimation of the population involved in such behaviour (Ross et al., 1977).

Here we aim to provide an understanding of the status and scale of wild animal parts trade in TAM, specifically the available African wildlife parts used as substitutes in TAM, and the involvement of Asian traders in the local African wildlife trade markets. We surveyed local African wildlife markets,

Traditional African Medicine (*muthi*) shops and TAM shops in South Africa, as well as TAM shops in Vietnam to compare different types of wildlife parts being sold in both markets, their origin and the use of these parts in TAM. In addition, the purpose of adopting these techniques was not only to estimate the number of violators but to evaluate the interview survey techniques by comparison to the direct observations.

2.3. Methodology

The study received ethical approval from the Research and Ethics Committee of the School of Anthropology and Conservation, University of Kent.

2.3.1. Study site

Market surveys in South Africa were conducted in Cape Town, Durban, Johannesburg and Pretoria. These locations were chosen as they are known to have large communities of Asian origin (Park and Rugunanan, 2008) and also some of the largest wholesale and retail markets for traditional medicine in South Africa (i.e. Warwick market in Durban, Faraday and Kwa-MaiMai market in Johannesburg) (Williams et al., 2011).

In Vietnam, surveys were conducted at TAM shops and clinics in Hanoi and Ho Chi Minh City, the two largest cities in the country with high rate of wildlife consumption (Drury, 2011). TAM shops and clinics were identified through a systematic survey in these cities.

2.3.2. Survey method

Market surveys were conducted in South Africa between 10th April and 30th October 2017 and in Vietnam between 20th September and 8th October 2017. In South Africa, all TAM shops, clinics, pharmacies, massage therapies and local wildlife markets selling ingredients for traditional medicines were surveyed at the four chosen cities by the author (TN), accompanied by a local assistant. Due to the

linguistic diversity of South Africa, at least one assistant fluent in isiZulu or Khoisan was always present at the market survey. Similarly, at least one assistant fluent in Mandarin or Cantonese was present at every interview with Chinese traders and practitioners in South Africa.
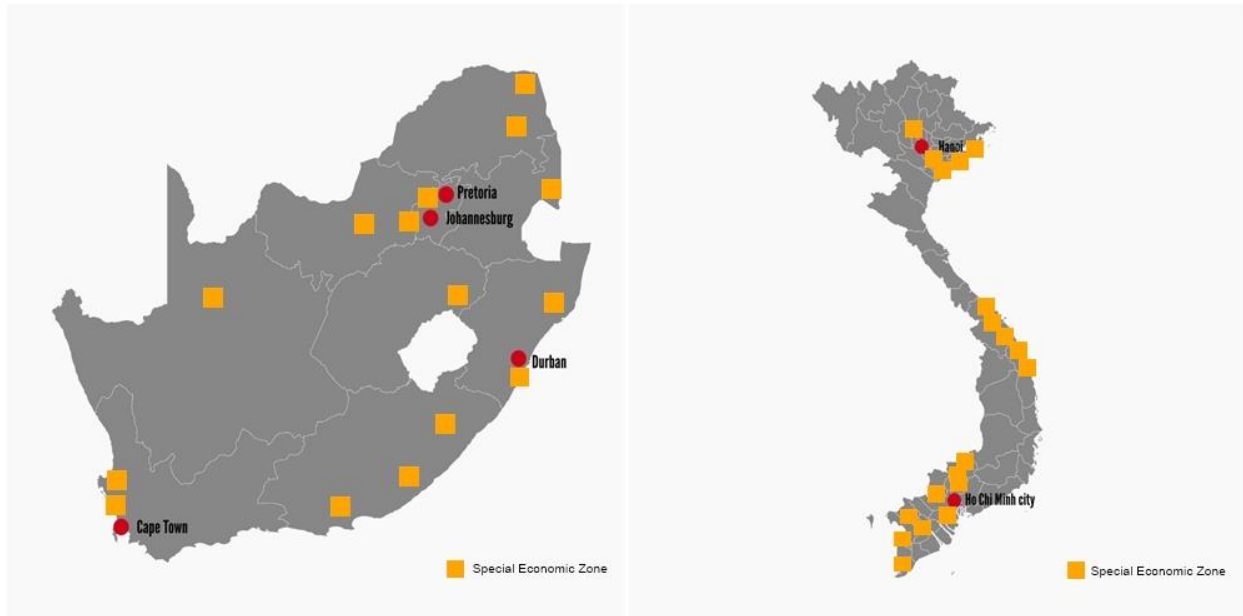
Figure 2.1. Surveyed locations in South Africa (Johannesburg, Pretoria, Durban and Cape Town) and in Vietnam (Hanoi and Ho Chi Minh city) and locations of special economic zones.

In Vietnam, TAM clinics, shops and pharmacies were surveyed in Hanoi and Ho Chi Minh City with the support of Vietnamese staff and volunteers of a local conservation NGO (WildAct) experienced in wildlife trade research. Each survey was carried out by pairs of interviewers to minimise risk and fatigue. In Vietnam, all surveys were conducted in Vietnamese. Prior to each interview, participants were given an oral consent form in English, isiZulu, Khoisan, Mandarin, Cantonese or Vietnamese.

2.3.2.1. Direct observation

Data were recorded on the number of wildlife parts, derivatives and products (such as pills, paste or powdered items), especially those from rhino, tiger, lion, pangolin and bear, as they are known

as endangered but popular wild animal used in TAM (Ellis, 2005). Animal taxa were recorded as stated by

vendors and confirmed visually by the author (TN) where possible. Pictures were taken of unidentified

parts with consent from vendors and sent to South African wildlife experts to seek further advice on

identification. It is not possible to easily distinguish visually between the bones of lions and tigers, or

between the gallbladders of bears and other similarly sized mammals such as pigs. Information was

recorded as advertised by the traders/practitioners.

Figure 2.2. Wildlife products found during the survey: a) pangolin scales and skeleton at Warwick

market, Durban, South Africa and b) dried bear bile found at Chinatown, Johannesburg, South Africa; c)

bear bile for sale in Hanoi, Vietnam and d) cooked tiger balm found in Ho Chi Minh city, Vietnam.

We recorded demographic details of the shop owners such as gender, age and education level. The retail prices stated in this research are the asking prices. In South Africa, prices were stated in South African Rand, and in Vietnam it was recorded in Vietnamese Dong. Prices were then converted into USD using the online exchange rates of Oanda (oanda.com) (1 USD=14.070 South African Rand on 10th April 2017; 1 USD=22.467 VND on 20th September 2017).

2.3.2.2. Interview surveys

Prior to the survey, the interviewers introduced themselves as a PhD student (and/or assistants of the student) from the University of Kent and that they would like to ask the potential interviewee some general questions about the use and trade of wild animal parts in traditional medicine. Potential interviewees were told that their participation was voluntary and they can refuse to answer any questions or stop the interview at any time if they feel uncomfortable. The interviewees were asked questions about their demographic, followed by FCB, RRT and finally direct questions (see supporting documents). On average, the interview took 40 - 50 minutes to complete.

In the FCB section, respondents were asked to estimate how many individuals among the people they know have been selling wild animal parts for traditional medicine purposes over the last 2 years. They were given ten categories to choose from (see Supporting documents). In the RRT section, interviewers asked participants closed end question and provide them a dice as a randomising tool. The dice had one green side, one red side and four blank sides. Participants were instructed to shake the dice in a cup to hide results from the interviewers and answer accordingly to the result of the dice roll. For example, if the dice came up red, participants will always say "no" as an answer and if the dice came up green, they will always say "yes". If the dice was blank, they need to answer the question truthfully. Three trial questions on non-sensitive behaviours were conducted with the respondents to ensure they understood the method.

In addition, direct questions (DQ) about sensitive behaviours were asked at the end of the survey. This result will be used as a baseline to compare with estimation obtained from direct observation, FCB and RRT.

2.3.3. Analysis

Data collected were coded and statistically analysed using the R 3.4.4 software program (R Core team, 2017). Chi-square tests were used for comparison between different groups for comparison between differences of gender, ages and ethical groups. The Bonferroni correction method is used to compensate for errors from multiple testing.

One-way ANOVA were used to test the difference in number of ingredients found as we expect there will be differences between *muthi*, TAM shops in South Africa and Asian owners. Samples were, therefore, grouped in to African *muthi* shop, TAM shops in South Africa and TAM shops in Vietnam. Due to the small sample size from the TAM shops in South Africa, it was grouped as one with TAM shops in Vietnam for this analysis. Results are significantly different if the *p* value is smaller than 0.05.

In addition, multidimensional scaling (MDS) technique was also used to analyse the market survey data. This technique uses similarities or dissimilarities between different variables in a data set as input. The similarity number indicates how similar variables are in term of relatedness. Similar variables, therefore, will appear closely in the map produced by MDS. In this study, value of all 17 species detected through direct observation across 183 shops were inputted for MDS analysis.

Data from RRT was analysed by using a formula adopted from previous research (St John et al., 2012):

$$\pi = \frac{(\lambda - \theta)}{s}$$

Where π is the estimated proportion of the respondents that have consumed the specified wildlife parts as TAM, λ is the proportion of all answers that are "yes", θ is the probability of the answer being a prescribed 'yes', and s is the probability of being asked to answer the question truthfully. 95% confidence intervals were calculated for FCB and RRT from 10,000 bootstrap (St John et al., 2010).

To analyse data obtained from FCB method, we counted the amount each category was chosen by respondents. The category that was chosen the most by respondents is used as the prevalent estimation. Respondents were also separated into users and non-users groups and FCB responses between groups were compared using Chi-squared test with Bonferroni correction. This allowed us to ensure the prevalence of behaviour is higher among those who admitted having sold protected wild animal parts in comparison to those who have not.

2.4. Results

2.4.1. Socio-demographic details respondents

A total of 183 shops and clinics were surveyed, 55.2% from African *muthi* clinics/shops (n=101), 15.8% from TAM clinics/shops in South Africa (as 97.1% of them are of Asian origin, hereafter Asian) (n=29) and 29.0% from Vietnamese TAM clinics/shops in Vietnam (n=53). Amongst the surveyed *muthi* shops, 72 respondents were South African, 12 were Mozambican, 12 were Mosotho, 4 were Swazi and 1 was Congolese. Within the TAM group in South Africa, 14 were Chinese or Taiwanese-South African (Chinese or Taiwanese born in South Africa), 11 were Chinese (from mainland China), 2 were non-Asian South African and 2 were Taiwanese. Demographic information of the respondents is summarised in Table 2.1.

More women were working in TAM shops than *muthi* shops, with 57.3% (n=47 out of 82) women working at TAM shops compared to 21.8% (n=22 out of 101) in *muthi* shops. A significant

difference was detected between *muthi* and TAM traders regarding their financial dependence on trading wildlife parts as traditional medicine ingredients (χ^2=160.274, df=1, p<0.001). All African *muthi* traders and practitioners stated that selling wildlife parts was their main income (100%), whereas only 32.9% of Asian and Vietnamese traders/practitioners reported this.

Table 2.1: Demographic information of respondents from *muthi*, TAM shops in South Africa and TAM shops in Vietnam.

	Muthi shop	TAM shops in South Africa	TAM shops in Vietnam
Gender			
Male	78.2% (n=79)	43.4% (n=12)	47.6% (n=25)
Female	21.8 % (n=22)	58.6% (n=17)	52.8% (n=28)
Average age	43.1	47.2	39.5
Range	21-79	30-78	17-70
Education			
Common highest:	Secondary school n=42	Secondary school n=10	College/university n= 53

2.4.2. Status and scale of the market

A total of 219 violations were observed from 183 surveyed shops. The most common observed violation was the sale of pangolin parts (n=95, 51.9%), followed by lions (n=57, 31.1%). Observations of bear parts (n=42, 23.0%) and tigers (n=19, 10.4%) were only found at TAM shops. Rhino horn was the least observed product; however, they were found for sale in all shop types (n=6, 3.3%).

There was a significant difference in the personal income of Asian and Vietnamese traders/practitioners and *muthi* trader (χ^2=68.136, df=2, p=0.001). 37.8% (n=31) Asian and Vietnamese

traders earning more than 1000 USD/month compared to 0.9% (n=1) *muthi* traders. There was also a significant difference between the frequency of restocking between TAM and *muthi* shops (χ^2=19.051, df=2, p=0.001).

Interview surveys showed that within the *muthi* respondents, RRT consistently produced higher prevalence estimates for the trade of all 5 focus species in comparison to direct question (DQ) and FCB. These patterns were also found at TAM shops in South Africa and Vietnam, with highest estimations yielded from RRT for all 5 focused species (Figure 2.3). There were significant differences between RRT and DQ amongst TAM respondents in South Africa and Vietnam regarding pangolin parts, but no difference was found for *muthi* respondents. Prevalence estimate obtained from RRT was significantly higher than DQ for lion parts amongst *muthi* and TAM respondents in Vietnam, however no difference was found for TAM respondents in South Africa.

Regarding rhino horn, prevalence estimations were statistically higher than DQ across all three groups. RRT estimations were also significantly higher for bear parts amongst TAM South Africa and Vietnam. This pattern was also found for tiger parts in Vietnam, however confidentce intervals overlapped between RRT and DQ regarding products from tiger within TAM respondents in South Africa. Amongst the *muthi* respondents, RRT confidence intervals overlapped between pangolin and lion parts, but significantly differed for rhino horn. Products from pangolin were significantly different to lions, bears and rhinos amongst TAM South Africa respondents, however bears and tigers did not differ. In the TAM Vietnam group, prevalence estimations obtained from RRT were significantly different across all 5 species. It is important to note that products from lion and tigers yielded an almost identical results. As lion parts are often used as substitutes for tiger parts in TAM, there is a possibility that consumers misidentified these products.
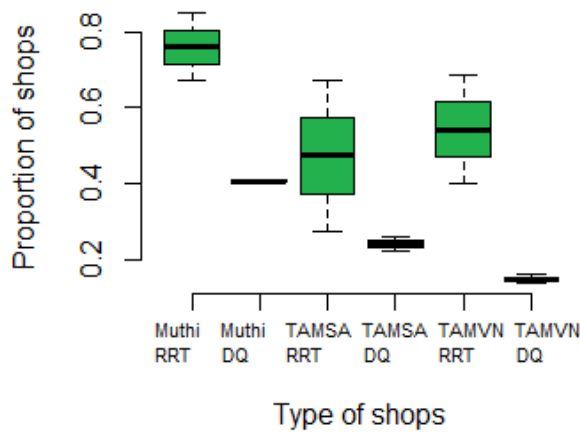
a) Pangolin
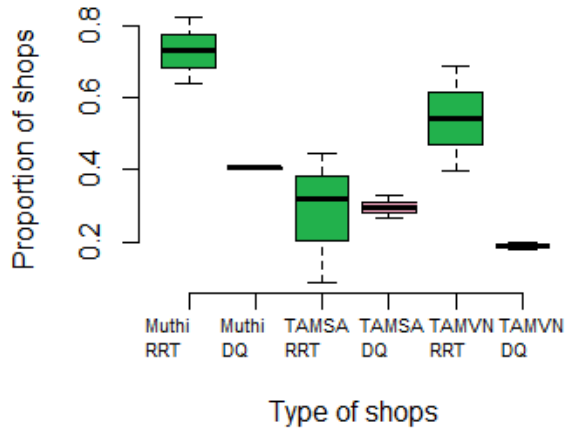
b) Lion
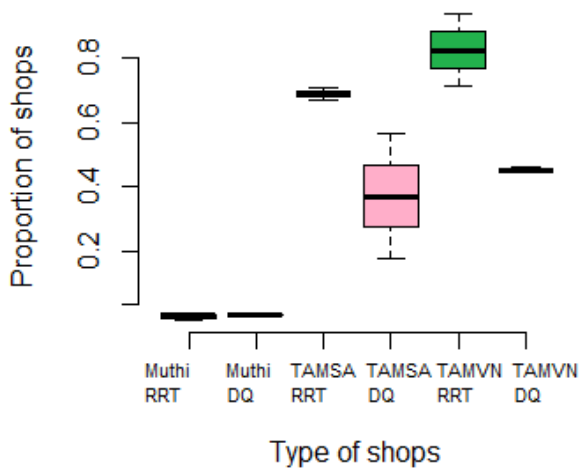
c) Bear
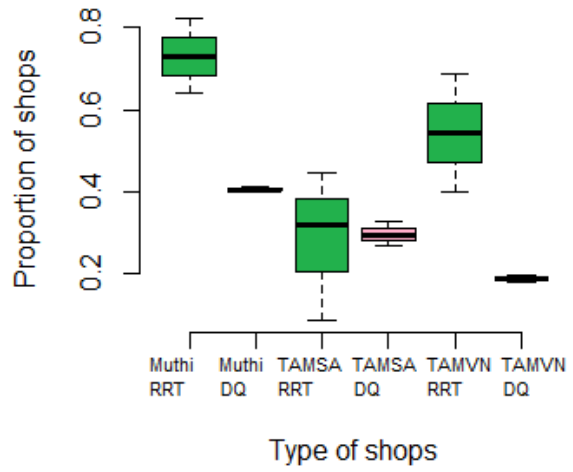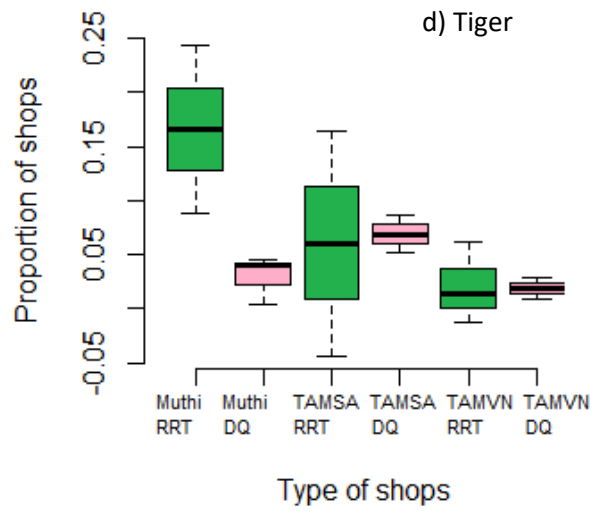
d) Tiger

d) Rhino

Figure 2.3: Prevalence estimates of a) pangolin, b) lion, c) bear, d) tiger and e) rhino part use obtained through Randomised Response Technique (RRT) in green bars and Direct Question (DQ) in pink bars for all shop types and locations: *muthi*, TAM in South Africa and TAM in Vietnam

Estimations from FCB are illustrated in Figure 2.4. Estimates for prevalence in the trade of all 5 products fell within the category 0-10%. No significant difference was found between the traders and non-traders of products from pangolin (χ^2=5.956, df=9, p=0.744); lion (χ^2=5.368, df=10, p=0.865) and rhino (χ^2=1.035, df=4, p=0.940). Bear and tiger parts were not analysed as respondents self-reported that they did not sell these two products in their shops within the *muthi* group. These animal parts were also not detected through the market survey.

Tests of the hypotheses were conducted using Bonferroni adjusted alpha levels of 0.01 per test (0.05/5). Results indicated no significant difference was found between traders and non-traders within the TAM group in South Africa for pangolin parts (χ^2=10.427, df=4, p=0.034), lions (χ^2=3.538, df=3, p=0.316), bears (χ^2=0.884, df=3, p=0.829), tigers (χ^2=0.042, df=3, p=0.998) or rhino (χ^2=5.368, df=10, p=0.865). In Vietnam, significant differences were also not found between traders and non-traders for products from pangolin (χ^2=13.756, df=7, p=0.056), lion (χ^2=1.336, df=2, p=0.513), bear (χ^2=3.128, df=4, p=0.537), tiger (χ^2=10.244, df=8, p=0.248) and rhino (χ^2=0.298, df=2, p=0.861).
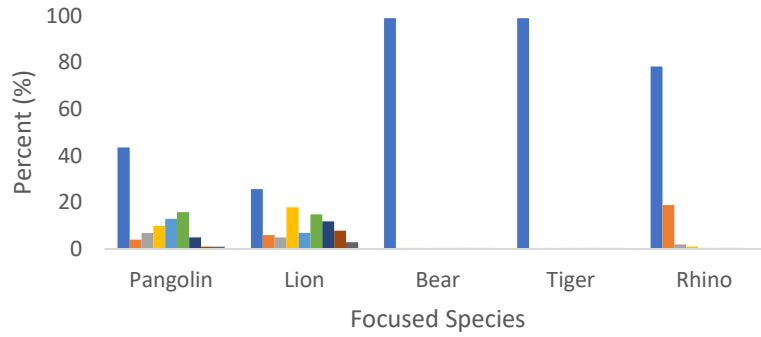
a) *muthi* shops
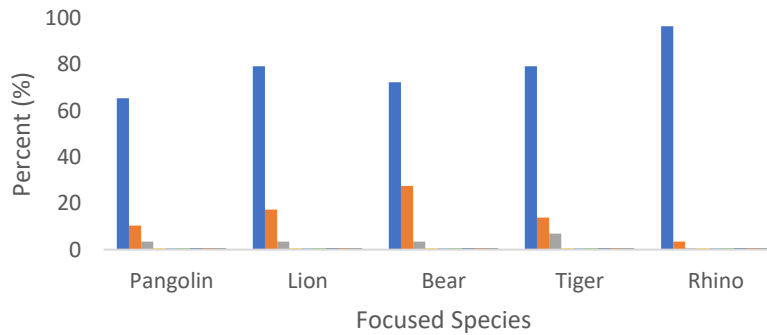
b) TAM shops in South Africa
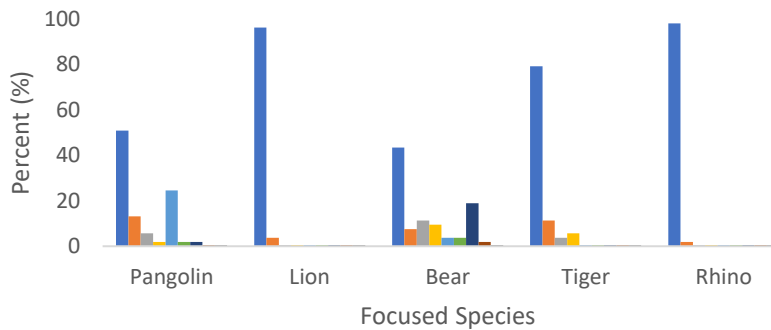
c) TAM shops in Vietnam

Figure 2.4: Trade of products made from pangolin, tiger, bear, lion and rhino was estimated by (a) *muthi* traders (n=101), (b) TAM traders in South Africa (n=29), (c) TAM traders in Vietnam (n=53) using False Consensus Bias (FCB). 10 different categories for respondents to choose from 0% - 100%.

2.4.3. Substitution

There was a significant difference between the type of cheapest ingredients nominated by traders across locations (χ^2=16.696, df=2, p=0.001). In both *muthi* and TAM shops, plants tended to be cheaper than animal parts, however there were more animal parts named as cheapest ingredients in *muthi* shop (mean price= 0.74$, median price= 0.52$) than in TAM shops in both South Africa (mean price= 8.56$, median price= 7.03$) and Vietnam(mean price= 6.32$, median price=5.11$). In general, prices of wild animal parts offered at *muthi* shops were significantly cheaper than those at TAM shops in South Africa and Vietnam (U=2128.000, p=0.024).

Most animal parts in South Africa offered at surveyed *muthi* shops came from local sources (54.5%), with 45.5% originating in other African countries as cited by respondents. None were imported from another continent. However, TAM shops in South Africa and Vietnam reported importing products containing wildlife parts from Asia and other African countries (34.2% and 4.8% respectively). For example, bear bile and bear gallbladders were found during this survey in TAM shops in South Africa, while lion balm (cooked lion bone) were found in 2 TAM shops in Vietnam. In addition, 3 TAM shops in Vietnam falsely advertised that it is legal to harvest tiger bone in Thailand and that they have imported tiger balm from there.

2.4.4 The trade in wild animal parts for medicine

The use of 5 focused animal species was recorded throughout the surveys in both South Africa and Vietnam (Table 2.2). Significant differences were detected using Bonferroni adjusted alpha levels of 0.01 per test (0.05/5). Amongst these species, there was a significant difference in the number of shops trading pangolin scales in *muthi* and TAM shops (χ^2=19.719, df=2, p<0.001). Pangolin scales were most frequently found in *muthi* shops (59.4%, n=60), compared with TAM shops in South Africa (13.8%, n=4)

and TAM shops in Vietnam (58.5%, n=31). Rhino horn was also found for sale in all three locations; however, it was rare; *muthi* shops (3.0%, n=3), TAM shops in South Africa (3.4%, n=1) and Vietnam (3.7%, n=2). There was a significant difference between the type of shops and lion product found (χ^2=39.374, df=2, p<0.001), with the largest number of *muthi* shops selling lion products in South Africa (50.5%, n=51), followed by 7.5% (n=4) TAM shops in South Africa and TAM shops in Vietnam (6.9%, n=2). Tiger bones were found only in TAM shops in South Africa (27.6%, n=8) and Vietnam (20.8%, n=11). There was no significant difference in the number of shops found with these products (χ^2=0.491, df=2, p=0.483). Similarly, bear products (bile and gall bladder) were not found at *muthi* shops, but TAMs in South Africa and Vietnam (χ^2=27.330, df=2, p<0.001) with 13.8% (n=4) the former and 74.50% (n=38) the latter. Two-way Anova showed that there was no significant interaction between 5 species (F=1.545, df=4, p=0.187).

Table 2.2: 5 focus species found across 101 *muthi* shops and 82 TAM shops in South Africa and Vietnam. Numbers shown in *muthi* column are the amount of wild animal parts counted. Numbers shown in TAM South Africa and Vietnam are the amounts of products containing wild animal parts counted.

Species	*Muthi*	TAM SA	TAM Vietnam
Rhino	3	1	2
Pangolin	4431	21	152
Tiger	0	31	55
Lion	1168	68	15
Bear	0	31	388

TAM shops had wider variation in the forms of ingredients offered than *muthi* shops (χ^2=139.630, df=1, p=0.001). For example, wild animal parts found in *muthi* shops were mostly stored as

dried and powdered form. However, TAM shops in South Africa and Vietnam processed animal parts in various forms: dried raw products (100%, n=82), boiled liquid ready to consume (14.6%, n=12), mixture of powdered animal parts and herbs with honey in a paste (13.4%, n=11), pills (47.6%, n=39) and "glue" or "balm" (8.5%, n=7).

Results from MDS are illustrated in Figure 2.5. Two distinct clusters were identified, cluster 1 includes wild animal that are commonly found at TAM shops (deer, tiger, bear, saiga, shark and seal) and cluster 2 includes the rest. It is worth noting that there were overlaps between some species, such as tiger and bear, lion and avian, elephant and giraffe.
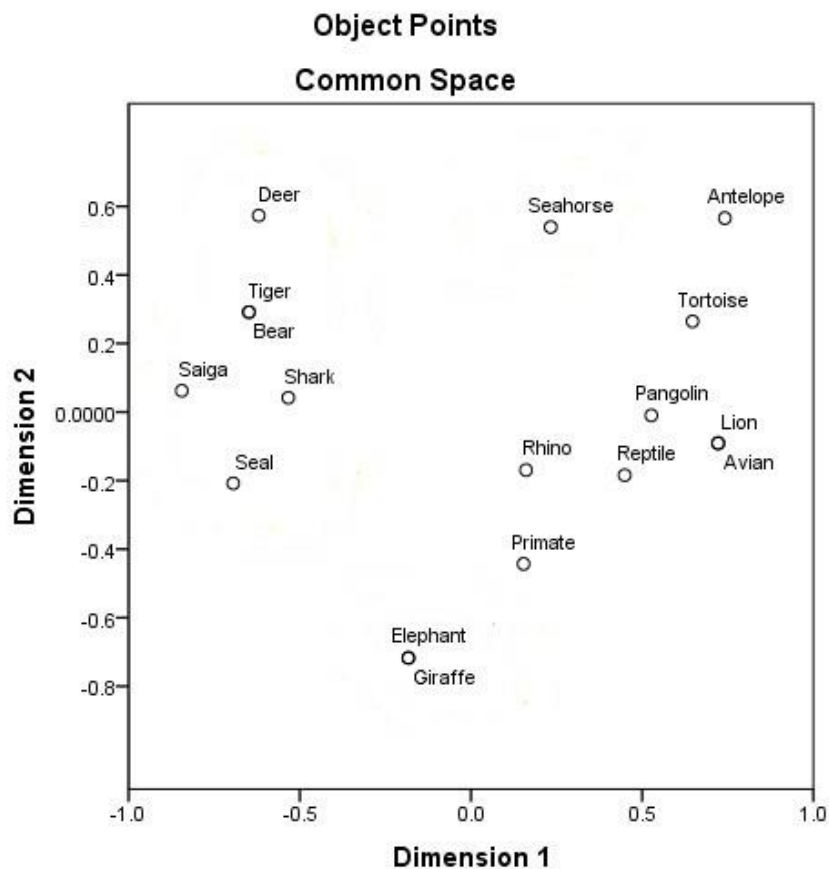
Figure 2.5: A two-dimensional MDS solutions of 17 wild animal parts found at a total of 183 *muthi*, TAM shops in South Africa and TAM shops in Vietnam. Dimension 1 shows probability of detection and Dimension 2 shows similarity similarities between species found.

2.5. Discussion

This research is the first in-depth study into the trade of wild animal parts for traditional medicine consumption in both South Africa and Vietnam. By comparing product availability in the three sample groups (*muthi* shops and TAM shops in South Africa, and TAM shops in Vietnam), we gained a knowledge of the use of wild animal parts in both countries and provide an understanding of the complex illegal trade between Africa and Asia. The results enable us to understand the market characteristics and identify target groups for future conservation initiatives.

2.5.1. The trade between Africa and Asia

Regarded as the most trafficked mammals in the world, the trade of pangolin parts is estimated to account for 20% of all illegal wildlife trade (Heinrich et al., 2016). In our survey, pangolin scales were the most frequently traded wild animal products found in both South Africa and Vietnam. Pangolin scales were offered in different forms: at the *muthi* market, they were sold as individual scales and the prices varied from 20 Rands (1.37 USD) to 60 Rands (4.12 USD), depending on the size of the scale. At TAM shops in South Africa and Vietnam, pangolin scales were often found as processed products, either ground up and mixed with other types of herbs as a prescription for illness, or made into commercialised products, such as pills, paste and liquor products.

Amongst the most frequently observed commercialised products found at TAM shops in South Africa were pangolin scales and tortoise shells that have been ground into powder or made into tablets. These tablets had a long list of applications, including the treatment of eczema, acne, scabbing, skin

allergic reactions, and genital infection. In Vietnam, pangolin scales labelled under the name "*xuyên sơn giáp*" as an ingredient for commercialised cough syrup have been advertised widely on the internet and television. This product can also be found at modern (or western) pharmacists across the country. It is noteworthy that these products, manufactured in Asia, were also found at 3 different TAM shops across South Africa, indicating that there is a demand for TAM products containing pangolin scales within the domestic market in this country.

In Vietnam, two TAM shops with lion balm were found in Hanoi and Ho Chi Minh City. Tiger bone products, such as tiger bone marinated rice wine, tiger balm (slow cooked bone into hard, gluey paste) and pills advertised to contain tiger bone as an ingredient were found at 8 TAM shops across South Africa. In addition, four TAM shops were found in Johannesburg and Pretoria, South Africa, with a dried bear gallbladder and bear bile products. According to the label, bear bile products were manufactured by the Chinese company Guizhentang Pharmaceutical. This indicates that, in addition to threatened wild animal parts being smuggled from Africa to Asia for consumption (Challender and Hywood, 2012; Heinrich et al., 2016; Pietersen et al., 2014; Williams et al., 2015), processed wild animal parts as TAM are potentially being trafficked into South Africa for domestic use.

It is important to note that all pangolin species, rhino, tigers and bears are listed on CITES Appendix I, and therefore the international commercial trade in parts and derivatives is prohibited. Although domestic trade in farmed bear bile is legal in China (Crudge et al., 2019), and there may not be a law in South Africa prohibiting sale of this non-native taxa, it remains largely illegal to import or export this product for commercial purposes.

Although the frequency at which rhino horn was found on display at *muthi* and TAM shops in both South Africa and Vietnam was low, the presence of this product indicates there is demand for rhino horn as an ingredient for traditional medicine usage in both countries. The low number of shops found

with rhino horn could be due to the increased sensitivity of the issues, and therefore rhino horn may not

be on open display, but rather off display elsewhere and only offered to trusted buyers.

The distinct clusters on MDS map showed that there are significant differences in species found

between *muthi* and TAM shops. In this study, MDS perceived similarities between species showing a

distinct order based on probability of detection. As expected, products of Asian origin and products

exclusively found in TAM shops, such as saiga, tiger and bear parts are grouped into one cluster. While

those that are found in both *muthi* and TAM shops appeared together in another cluster. Elephant and

giraffe parts, which were only detected at *muthi* shops, appeared separately, but closer to the latter

cluster. There were overlaps between detections of products from bear and tiger, elephant and giraffe,

as well as lion and birds. These overlaps suggest that shops offering one product such as bear parts are

also likely to sell the other products (i.e. tiger parts). The overlap between lion and birds is curious and

maybe explained by the use of bird and lion parts in *muthi* practices (Whiting et al., 2013).

Our survey results also indicated there is a significant difference in prices of wild animal

products for sale at *muthi* shops and TAM shops in both South Africa and Vietnam. One of the reasons

for this could be because wildlife parts at *muthi* shops were often sold as raw ingredients, whereas TAM

shops processed their products into a more convenient form to consume, such as pills, liquors and

paste. In addition, Asian originated products, such as bear bile and gall bladder, are likely to have been

smuggled into South Africa as the species are not native to the country. The prices of TAM products,

therefore, tends to be higher than those from *muthi* shops.

2.5.2. Poverty, livelihoods and the Chinese influence

China has been cultivating relationships with various developing regions of the world (Hughes,

2019; Lechner et al., 2018). In Africa, China's policy aims to secure natural resources and consumer

markets, and to establish China's status as a leader in the developing world (Duggan, 2014). China's

phenomenal economic growth resulted in a mounting need for energy and raw materials to fuel the

Chinese economy, and a subsequent need for markets in which to sell Chinese products (Chen and

Duggan, 2016). From 2009 to 2011, the total volume of Chinese African trade reached almost USD200

billion. Within this period, China's export to Africa accounted for USD85 billion, while China's imports

from Africa accounted for USD113 billion (Information Office of the Chinese State Council, 2013).

An increased flow of capital and visitors from China has been linked to increased trade in wildlife

products (Krishnasamy et al., 2018; Livingstone et al., 2018; Nguyen and Frechette, 2017). In 2013,

Chinese arrivals, including those from Hong Kong, to South Africa reached 151,847 individuals,

representing a 14.7% increase over the previous year. In 2014, China also became a core market for

South Africa along with the United States, the United Kingdom, Germany and India (Chen and Duggan,

2016). In order to maximize economic benefits for African countries, local African tour operators need to

learn Chinese language and culture, as well as to understand preferences and behaviours (Kings, 2014).

In addition, the establishment of BRI and SEZs pose a potential threat to the African wildlife through

increasing the Chinese consumer population and transmitting cultural practices to the local populace.

The consumption of wildlife products through TAM practice has been shown to spread to the local

African peoples (Chapter 3).

The illegal trade of wildlife has long been associated with rural poverty and the growth of wealth

in consumer groups (Atuo et al., 2015; Brashares et al., 2011; Challender and MacMillan, 2014). Poverty

may be the driver amongst the *muthi* traders/practitioners' group in trading threatened wildlife parts,

with the majority (85.1%) being in the low-income class, earning less than 6000 Rands/month (412 USD).

However, our results showed that TAM traders/practitioners in South Africa and Vietnam were not

under the same financial pressure, with 37.8% having incomes above 1000 USD; amongst the middle-

high income class in both South Africa and Vietnam (Visagie, 2013; General Statistic Office of Vietnam, 2018). While all *muthi* respondents working at *muthi* shops stated it is their main income, only 32.9% of TAM respondents in both South Africa and Vietnam depend solely on income from TAM. As noted previously, it appears *muthi* traders are being coerced by Chinese buyers to provide illegal wildlife products to satisfy the demand for TAM.

2.5.3 The application of different methods to detect wildlife trade

We compared specialised questioning techniques, direct questioning and observations to detect wildlife trade. In general, RRT yielded the highest estimations of wild animal products being sold in the market in compared to FCB and DQ. Significant differences between RRT and DQ shown that overall, the trade of all 5 species were considered as sensitive by *muthi*, TAM South Africa and TAM Vietnam traders. *Muthi* traders had the highest prevalent estimations for pangolin, lion and rhino parts, which may be expected based on the availability of these products in South Africa, as well as their use in *muthi* practices (Whiting et al., 2013). Significant differences in the estimation of tiger and bear parts trade between TAM in South Africa and Vietnam could be explained by the availability of these products (i.e. bear parts are more available in Vietnam than South Africa). The high prevalence of tiger products in South Africa could be due to the overlap with lion products and/or South African domestic regulation is not yet in place to protect tiger parts trade. As such tiger parts could be being traded more frequently in South Africa than Vietnam. In addition, results show a similarity between lion and tiger products, this is more likely due to the mistaken identity of these two products, as lion parts are being used as alternative for tigers.

FCB estimations for the trade of all five species were very low (0-10%), which is lower than DQ for pangolin, lion, bear and tiger. Significant differences in respondents' estimations using FCB was not detected between users and non-users, which means the prevalence of behaviour is not higher among

those who admitted having selling protected wild animal parts in comparison to those who have not in this study. While it could be that the trade in these species is rare, there is the possibility that traders intentionally provided a lower estimate so as to give an impression that the products are rare and exclusive to their shop. FCB appears not to be successfully under this scenario.

Overall, our results show that endangered wildlife parts are being traded for TAM purposes in South Africa and Vietnam, both domestically and internationally. The trade of Asian originated species, such as tiger and bear are much higher than one may expect in South Africa. In this study, RRT was successfully applied in both South Africa and Vietnam, showing a higher rate of detection of wildlife parts compared to direct observation. However, FCB did not appear to be effective in estimating prevalence of wild animal parts trade. In addition, future studies should explore the application of other SQTs (Bova et al., 2018; Nuno et al., 2013) in detecting wildlife trafficking, in particular those that have yet to be tested in the field.

2.6. Conclusion

The results of this study highlight the need to develop effective methods for detecting and monitoring illegal wildlife trade. Monitoring of the trade requires a suite of complementary approaches, as trade may become more covert over time, it is important not to rely solely on direct observations or direct questioning. Although it may take time to redress legislative weaknesses that exist in terms of enforcing protection of non-native species, customs and border agencies should record and report all suspected cases of wildlife trafficking, and where possible instances where no punitive action has been taken.

Threatened wildlife parts are not only smuggled from Africa to Asia for consumption, but wildlife parts from Asia are being trafficked into Africa for domestic consumption or sale within Africa. Despite some laudable efforts, most notably anti-poaching and tighten security at airports and borders,

South Africa's inability to better conserve its wildlife is partly driven by lack of resources and capacity to respond to the impacts of Chinese investment. Such investment needs to be matched by resources for mitigating impacts, including support for effective enforcement against illegal wildlife trade. The high level of wild animal parts for sale in South Africa presents a challenge for effective conservation management. Traditional African medicine is known for its use of wild animal parts, but the practice of TAM in this country may put more pressure on the fragile populations of protected species in the continent. In addition, improving wildlife law enforcement and providing protection for non-native species in domestic legislation in both South Africa and Vietnam is required to ensure the survival of these species.

2.7. Acknowledgement

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2.9. Supporting documents

Hello, my name is _____. I am a PhD student from the University of Kent in England and I would like to ask you some general question about the use and trade of wild animal parts in traditional medicine. Your answers are anonymous. I will not record your name and your participation in this study is voluntary. You can refuse to answer any questions or stop the interview at any time if you are uncomfortable.

Please could you confirm that you are happy to participate in this study? If yes, please tick this box ❒

1. We would like to ask you for the following demographic information to help us make general conclusions regarding the views of Traditional Medicine traders and practitioners. Your responses will remain completely confidential.

a. What is your gender? ❒ Male   ❒ Female

b. What is your age?   _____ years

c. What is the highest level of education you have completed?
❒ None
❒ Primary school
❒ Secondary school/High school
❒ College/University
❒ Masters/PhD

d. What is your nationality?
_____

e. What is your ethnicity?
_____

2. What is your role in the shop?

❒ Owner   ❒Worker   ❒ Doctor
❒ All of the above

3. What is the most expensive ingredient in your shop?_____

How much does it cost?_____

4. What is the cheapest ingredient in your shop?_____

How much does it cost?_____

5. How often do you restock your ingredient?

❐ Once every month   ❐ Once every 3 – 6 months

❐ Once every 3 months   ❐ More than 6 months.

6. Is working here your main income?   ❐Yes   ❐No

7. What is your monthly income?

❐Under 1500 Rands   ❐1500 – 5000 Rands   ❐5000 – 10,000 Rands

❐10,000 – 15,000 Rands   ❐15,000 – 20.000 Rands   ❐ Above 20,000 Rands

❐ I do not want to answer.

False Consensus Bias (FCB)

Think of your friends and family members. How many of them do you believe over the last 2 years

1. have traded pangolin parts in TAM;	a.0-10%	b.11-20%	c.21-30%	d.31-40%	d.41 – 50%
	e.51-60%	f.61-70%	g.71-80%	h.81-90%	i. 91-100%
	a.0-10%	b.11-20%	c.21-30%	d.31-40%	d.41 – 50%
2. have traded lion parts in TAM;	e.51-60%	f.61-70%	g.71-80%	h.81-90%	i. 91-100%
	a.0-10%	b.11-20%	c.21-30%	d.31-40%	d.41 – 50%
3. have traded bear parts in TAM;	e.51-60%	f.61-70%	g.71-80%	h.81-90%	i. 91-100%
	a.0-10%	b.11-20%	c.21-30%	d.31-40%	d.41 – 50%
4. have traded tiger parts in TAM?	e.51-60%	f.61-70%	g.71-80%	h.81-90%	i. 91-100%
	a.0-10%	b.11-20%	c.21-30%	d.31-40%	d.41 – 50%
5. have traded rhino parts in TAM?	e.51-60%	f.61-70%	g.71-80%	h.81-90%	i. 91-100%

Please circle the category that is correct for your answer.

Randomised Response Technique (RRT)

1. Have you ever trade pangolin parts in TAM over the last 2 years?

2. Have you ever trade lion parts in TAM over the last 2 years;

3. Have you ever trade bear parts in TAM over the last 2 years;

4. Have you ever trade tiger parts in TAM over the last 2 years?

5. Have you ever trade rhino parts in TAM over the last 2 years?

Direct Question (DQ) (Yes/No answer)

1. Have you ever trade pangolin parts in TAM over the last 2 years?

2. Have you ever trade lion parts in TAM over the last 2 years;

3. Have you ever trade bear parts in TAM over the last 2 years;

4. Have you ever trade tiger parts in TAM over the last 2 years?

5. Have you ever trade rhino parts in TAM over the last 2 years?

Thank you for your participation!

Chapter 3

Attitudes towards endangered animal species among

Traditional Asian Medicine practitioners in South Africa and Vietnam

Nguyen, T., Roberts, D.L. Attitudes towards endangered animal species among Traditional Asian Medicine practitioners in South Africa

3.1. Abstract

Demand for wildlife parts for use in Traditional Asian Medicine (TAM) from within Southeast Asian countries is impacting wildlife populations beyond Asia into regions such as Southern Africa. With increased globalisation and movement of people around the world, there are concerns about the spread of unsustainable practices including the utilisation of wildlife in traditional medicines. This study aimed to: i) evaluate the potentially important and understudied market for endangered wildlife products used as TAM in South Africa; and ii) understand the similarities and differences between Traditional African Medicine (known as *muthi* in South Africa) and Asian TAM practitioners' values, attitudes, behaviours and knowledge regarding the use of wildlife products. Between March and November 2017, we interviewed 183 *muthi* and TAM traders and practitioners in both South Africa and Vietnam. Our results show that even though there is a preference for Asian endangered species, African species are accepted as alternatives for use in TAM. With wildlife populations depleted throughout much of Asia, the willingness of Vietnamese TAM traders and practitioners to shift consumption to African substitutes, coupled with a lack of concern or understanding, represents a considerable threat to Africa's endangered wildlife. The use of TAM in South Africa, particularly beyond the Asian diaspora, has the potential to shift South Africa from being mainly a "source" to a predominantly "consumer" country. The relatively short trade chain from poachers to consumers within South Africa, and therefore the limited opportunity for law enforcement interventions, make demand-side responses, such as social marketing, even more important.

Keywords (6 keywords)

consumption, demand, diaspora, immigration, illegal wildlife trade, *muthi*, Traditional African Medicine

3.2. Introduction

The illegal trade in wildlife for use in traditional medicines has led, in a number of cases, to overexploitation, resulting in population declines and threatening species' existence (Davis et al., 2016; Ferreira et al., 2015). Both 'Traditional Asian Medicine' (TAM) and 'Traditional African Medicine', also known as *muthi* in South Africa, use a wide range of animals and plants. A focus of much attention is the use of endangered animal products (Boakye et al., 2015; Votrubova et al., 2017; Zhang et al., 2008).

The use of wild animals for medicinal purposes, as well as for social and cultural purposes, has been documented in both Africa and Asia (Williams and Whiting 2015; Zhang and Yin, 2014). Various forms of TAM, including the Traditional Vietnamese Medicine (TVM), are highly influenced by the Traditional Chinese Medicine (TCM) (Pham et al., 2013). Wildlife parts and derivatives, such as bear gall bladder/bile, rhino horn, tiger bones and pangolin scales, have been described in both TVM and TCM's text books for thousands of years (Do et al., 2006; Nowell, 2012), although, due to conservation concerns around such species, an increasing number are being removed from pharmacopoeias and list of approved ingredients (e.g. by the Vietnamese health ministry).

Practitioners and consumers of TAM and *muthi* often believe that wild animals obtained their strength through foraging in the wild (Dutton et al., 2011; Ellis, 2005; Pujol, 1990). Through the consumption of a wild animal's body parts it is believed that consumers will gain health benefits, such as the power and strength of the wild animal (Ellis, 2005; Williams and Whiting, 2015). For example, *muthi* practitioners and consumers believe that lion parts will not only strengthen the body, but also bring good luck and protection against evil spirits (Mander et al., 2007; White et al., 2004). In TAM, a tiger is considered to be a "walking pharmacy" – every single part of its body can be used for medicinal purposes (Linacre and Tobe, 2008; Nowell, 2010; Stoner and Pervushina, 2013).

South Africa is home to the largest Asian diaspora in Africa, of which the majority are Chinese, with an estimated 250,000 - 300,000 migrants (Park and Chen, 2009). Although many Chinese migrants plan to eventually return to China, many have stayed in South Africa (Park and Chen, 2009). As a result, Chinese workers and traders, as well as other Asian diaspora, have established communities throughout Africa. During an 18-month study of new Chinese immigrants in the South African province of Free State, Park and Chen (2009) found that almost every major and secondary town had at least one Chinese store.

Ekor (2014) estimated that approximately 72% of black South Africans use traditional medicines. It has been suggested that this is due to a lack of access to university-trained doctors in rural areas (Whitting and Hibbitts, 2013). However, traditional medicines are often considered a cheaper alternative to pharmaceutical drugs, and are considered easier to access and sometimes considered to be more culturally appropriate (Mander et al., 2007). For example, cultural beliefs in health and illness, such as side effects of modern or Western medical treatments compared to traditional medicines could be a barrier to improved adherence (Chen et al., 2009; Cheng et al., 2013; Stark et al., 2008).

With the rise in the Asian diaspora, particularly those of Chinese heritage in South Africa, demand for African wildlife parts, such as African rhino horns, lion bones and pangolin scales, for traditional medicine purposes has the potential to increase. In 2011, China signed 91 TAM partnership agreements in which TAM treatment is legally accepted in over 70 countries, including a number of African countries including Kenya, the DR Congo and South Africa (Wang and Li, 2013). Reports from South Africa stating Chinese and Vietnamese involvement in wildlife trafficking and practices, including gill-net fishing and abalone trade, as well as elephant ivory, pangolin and rhino horn smuggling, have increased in recent years (Park. 2012). Of the Asian citizens arrested for rhino-related crimes in South Africa, 56% were Vietnamese, 28% were Chinese and 31% were Malaysian or Thai (Milliken and Shaw.

2012). As a result, Vietnam has emerged in recent years as a primary source of demand for wildlife products from southern Africa, as well as a transit country for rhino horn (Milliken et al., 2012).

A number of studies have investigated the consumption of wildlife products through TAM in Asia (Dutton et al., 2011; Moltke and Spaninks, 2000; Still, 2003), but little is known about the use of TAMs in Africa or how it may influence local communities' behaviour towards wildlife consumption. Understanding of the use of animal parts in TAM practices in South Africa is therefore fundamental to an understanding of the threats to African species. This study aims to investigate whether TAM has been accepted and is being practiced by local African traditional medicine practitioners. It also aims to explore the acceptance of African wild animal parts as alternative to Asian species by Asian TAM practitioners in South Africa, due to their local availability. Finally, the study aims to provide an understanding of knowledge, preferences and attitudes toward the use of wild animal products in TAM by practitioners in South Africa.

3.3. Methodology

The study received ethical approval from the Research and Ethics Committee of the School of Anthropology and Conservation, University of Kent.

3.3.1. Study site

Surveys in South Africa were conducted at the local *muthi* markets, TAM clinics and shops in 'China Towns' in Cape Town, Durban, Johannesburg and Pretoria. These cities were chosen as they are known to have a large community of Asian diaspora (Park and Rugunanan, 2008), and clusters of shops selling wild animal parts for traditional medicine was recorded (Chapter 2). In Vietnam, surveys were conducted at TAM shops and clinics in Hanoi and Ho Chi Minh City, the two largest cities in the country

(Drury, 2009; Hansen et al., 2012). Through a systematic survey in these cities, TAM shops and clinics were identified.

3.3.2. Survey methods

Surveys were carried out in South Africa between 30th March and 20th October 2017, and in Vietnam between 30th September and 20th November 2017. The questionnaire was developed in English, with input from several experts in social science. At the start of the survey period, a pilot survey was carried out in Johannesburg with 20 individuals of Asian descent living in South Africa. Results from this pilot survey were used to define the final questionnaire used. Local research assistants were recruited to conduct surveys in South Africa and Vietnam. Thirty-four research assistants participated in two-day training courses on how to deliver the survey and record data.

TAM shops, clinics, pharmacies, massage therapists and local wildlife markets selling ingredients for traditional medicine purposes were randomly surveyed in all four cities in South Africa. In Vietnam, TAM clinics, shops and pharmacies were surveyed randomly. Each survey was carried out by pairs of research assistants. The interviewers introduced themselves as a PhD student (and/or assistants of the student) from the University of Kent and that they would like to ask the potential interviewee some general questions about the use and trade of wild animal parts in traditional medicine. Potential respondents were informed that their participation was voluntary and they can refuse to answer any questions or stop the interview at any time if they feel uncomfortable. Due to the linguistic diversity of South Africa, at least one research assistant fluent in isiZulu or Khoisan was present at every survey with local traders and practitioners. Similarly, at least one research assistant fluent in Mandarin or Cantonese was present at every interview with Asian traders and practitioners.

We divided our sample population into three different groups: (1) *muthi* healers and traders; (2) practitioners and traders of TAM – most are of Asian heritage in South Africa; (3) Vietnamese practitioners and traders of TAM in Vietnam.

At the start of each survey, participants were given an oral consent form in English, isiZulu, Khoisan, Mandarin, Cantonese or Vietnamese. To avoid misunderstandings, the concepts of "wildlife farming", defined as the rearing of non-domesticated animals in an agricultural setting to produce whole living animals and commodities such as food, traditional medicine and fibre, and "cancer", defined as the growth of a tumour/s resulting from uncontrolled division of cells, were explained to participants prior to being asked questions on those topics.

The majority of the questionnaire comprised closed questions, with some open questions used to collect information on the interviewee, such as their age, nationality and ethnicity (see Supplement documents). The first section of the questionnaire focuses on attitudes toward TAM and wild animal parts as TAM ingredients. The second section focuses on preferences toward different ingredients used in TAM, particularly endangered wildlife products used in TAM, including bear bile/gall bladder, rhino horn, tiger/lion bone, and pangolin scales. The third section of the questionnaire focuses on demographics. Interviewers read the question to respondents and recorded responses accordingly. These responses were imported into an Excel spreadsheet after each day and coded for analysis.

3.3.3. Analysis

Survey responses were coded and statistically analysed using the R 3.4.1 software program (R Core team, 2017). Traders and practitioners of *muthi*, TAM in South Africa and TAM in Vietnam were treated as separated group for Chi-square tests. This test was used for association between nationalities, genders and age-groups with responses to questions on the use of wildlife parts in

traditional medicines. The Bonferroni correction method was adopted to compensate for errors from multiple testing. Kruskal-Wallis test was used to analyse data from ranking questions on traders' and practitioners' preferences towards wildlife parts and medical treatments.

3.4. Results

A total of 183 surveys were completed, 55.2% from African *muthi* traders/healers (n=101), 15.8% from TAM traders/practitioners in South Africa (as 97.1% of them are of Asian origin, hereafter Asian) (n=29) and 29.0% from Vietnamese TAM traders/practitioners in Vietnam (n=53) (See Table 3.1).

Table 3.1: Demographic of sampled *muthi* traders, TAM traders in South Africa and TAM traders in Vietnam

		Muthi traders (n=101)	TAM traders in SA (n=29)		TAM traders in Vietnam (n=53)	
Gender	Male	79	12		25	
	Female	22	17		28	
Ethnicity	South African	72	Asian	14	Vietnamese	53
	Mozambican	12	Chinese (mainland)	11		
	Mosotho	12	Taiwanese	2		
	Etswatini	4	Non Asian – SA	2		
	Congolese	1				
	Age range	21 – 79	30 – 78		27 – 70	
	Mean age	43.1	47.2		39.5	

3.4.1. Value of TAM

A Kruskal-Wallis test showed significant differences in the primary reasons for customers to choose TAM over other types of medical treatments between all three groups: the Asian and

Vietnamese groups expressed a stronger interest in the traditional value of TAM than did African *muthi*

traders/healers (H= 182.000, df=2, p<0.001) with a mean rank traditional value score of 116.0 for Asian

and 157.0 for Vietnamese compared to 51.0 for African. According to the African *muthi* traders, the

main reason for African customers to choose TAM rather than *muthi* was because the medicine can be

personalised according to the patient's needs and preferences (H=89.466, df=2, p<0.001), mean rank for

product personalization score of African respondents was 121.0, Asian was 61.3 and Vietnamese was

53.5. African respondents believed that TAMs have no negative side effects (H =62.548, df=2, p<0.001)

with mean rank of 117.1 for African, 70.8 for Asian and 55.8 for Vietnamese. Long-lasting effects was

also ranked highly by African respondents (H= 37.819, df=2, p<0.001), with 111.1 for African, 71.5 for

Asian and 66.9 for Vietnamese. Price of TAMs (H=16.108, df=2, p<0.001) were both ranked low by all

three groups, mean scores 90.5 for African, 100.0 for Asian and 90.6 for Vietnamese (Figure 3.1).
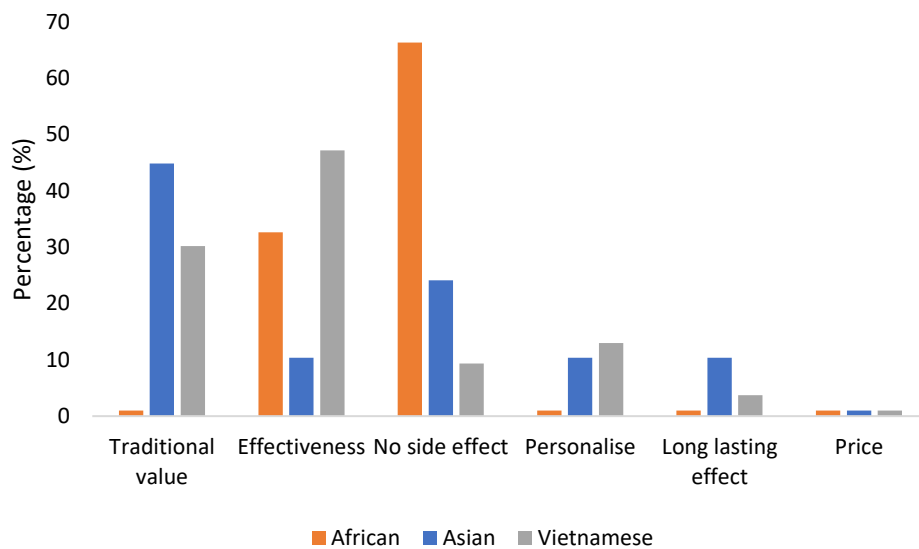
Figure 3.1: Reasons for customers/patients to choose TAM over other medical treatments, as reported

by TAM and *muthi* traders and practitioners, as a percentage of total response.

3.4.2. Knowledge and perception

The results showed that, as one may expect, Asian and Vietnamese respondents have higher understanding of the use of wildlife products in TAMs than African *muthi* traders and practitioners. A higher proportion of African respondents believe rhino horn to be a cure for cancer than Asian and Vietnamese respondents (χ^2=11.123, df=2, *p*=0.020). As expected, the Asian and Vietnamese groups were also more knowledgeable about the bear bile trade in Asia than the African group, with a higher number of respondents aware that bile might still come from wild bears (χ^2=14.163, df=2, *p*=0.049).

Significant differences were found among 3 groups regarding their concerns when prescribing wildlife products to their patients: poison was ranked highest by muthi traders (H=26.768, df=2, p<0.001), mean rank 106.5 for muthi, 92.0 for Asian and 64.4 for Vietnamese. Vietnamese respondents are most concerned about purchasing fake products (H =10.776, df=2, p=-0.005), mean rank of 91.3 for African, 69.2 for Asian and 105.8 for Vietnamese. Disease transmission was a concern among a majority of Asian respondents (H=8.148, df=2, p=-0.017), mean rank 87.4 for African, 116.5 for Asian and 87.4 for Vietnamese. Significant difference was also found between the three groups regarding legality of products (H=7.122, df=2, p=-0.028), mean rank of 91.8 for African, 73.3 for Asian and 102.5 for Vietnamese. No significant difference was found between the three groups regarding extinction of species due to the use of wild animal parts in traditional medicine (H=3.751, df=2, p=-0.153), mean rank 95.2 for African, 96.6 for Asian and 83.4 for Vietnamese (Figure 3.2).
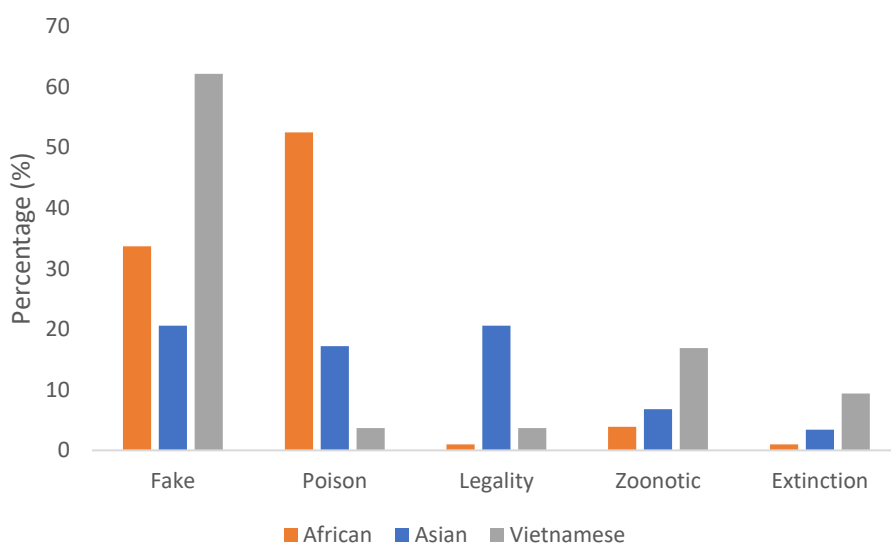
Figure 3.2: Highest concerns of TAM and *muthi* traders and practitioners when prescribing wild animal parts as ingredients in traditional medicine, as a percentage of total responses.

When it came to the use of rhino horn as medicine, Asian and Vietnamese groups named a wider range of uses than African respondents (χ^2=20.108, df=2, *p*=0.001). Beside the use of rhino horn for cancer treatment and as aphrodisiacs, which were recorded among all three groups, asthma treatment (Asian: 17.2%, Vietnamese: 3.8%) and fever reduction (Asian: 13.8%, Vietnamese: 9.4%) were named only by the Asian and Vietnamese groups. In total, 96.6% of Asian (n=28), 94.3% of Vietnamese (n=50) and 100% (n=101) of African respondents stated that they would use rhino horn as medicine.

Within our sample, the Asian group held higher belief that TAM is beneficial to African society through employment (χ^2=42.898, df=2, *p*=0.001) and medical services (χ^2=12.308, df=2, p=0.011) than respondents in the African group. This question was excluded from the analysis for the TAM traders and practitioners in Vietnam as they are not living in South Africa. In comparison to both Asian and African groups, most Vietnamese respondents did not consider the use of wildlife products in TAMs to be a

threat to African wildlife (χ^2=12.050, df=2, *p*=0.010) or that consumption could result in a decline of wildlife populations (χ^2=35.793, df=2, *p*=0.001). These significant differences were recorded at 0.012 due to Bonferroni correction (0.05/4).

All three groups agreed that African wildlife can be used as an alternative for Asian wildlife in TAMs (χ^2=20.845, df=2, *p*=0.019). They also believed that Asian and African pangolin scales have the same effectiveness in treating illness (χ^2=0.513, df=2, *p*=0.772). However, the Asian respondents disagreed that lion bone was an alternative for tiger bone (χ^2=12.000, df=2, *p*=0.012). In addition, Asian respondents did not believe that bile from wild animals had stronger medical effects than those from farmed in comparison to respondents from African and Vietnamese groups (χ^2=21.865, df=2, *p*=0.001). Bonferroni correction recognized significant differences at 0.012 (0.05/4).

Ninety-six percent of respondents of all groups agreed with the statements that wild animal parts are essential for their traditional medicines (both TAMs and *muthi*), and that the use of wildlife parts for medicine is an important part of their culture. However, significantly more Asian respondents disagreed with these two statements than the African and Vietnamese group (χ^2=32.527, df=1, *p*=0.001 and χ^2=12.275, df=1, *p*=0.020 respectively). Of all respondents, 99% agreed that it is easy to buy wildlife products in Africa for TAMs.

When asked whether wildlife products, such as rhino horn, tiger bone, lion bone, pangolin scales and bear bile should be available for TAM use, Asian respondents were significantly less likely to be open to the use of rhino horn (χ^2=30.810, df=2, *p*=0.001), lion bone (χ^2=15.391, df=2, *p*=0.001) and pangolin scale (χ^2=11.956, df=2, *p*=0.003) than those from Vietnam and Africa. There is no significant difference between the three groups when asked about the use of bear bile/gall bladder in TAMs

(χ^2=0.861, df=2, p=0.650) and tiger bone (χ^2=28.207, df=2, p=0.012) (significant difference recorded at 0.01 due to Bonferroni correction 0.05/5).

Those aged 40 - 65 and above in all groups were more open to the use of rhino horn as medicine (χ^2=9.784, df=4, p=0.002). All other results showed no significant differences in response attribute to age group and gender.

3.4.3. Preference and attitudes

The results of the final section of the questionnaire, in which participants were asked to choose between two options, showed there are significant differences in respondents' preferences for wildlife parts used in TAM after Bonferroni correction at 0.005 (0.05/9). A majority of *muthi* traders and practitioners prefer to use bear gallbladder rather than bear bile in comparison to the Asian and Vietnamese (χ^2=44.020, df=2, p=0.002). No significant difference was found between groups' choice of farmed tiger bone or wild tiger bone (χ^2=35.743, df=2, p=0.011) nor interest in using bear bile/gallbladder than herbal alternative (χ^2=35.796, df=2, p=0.010).
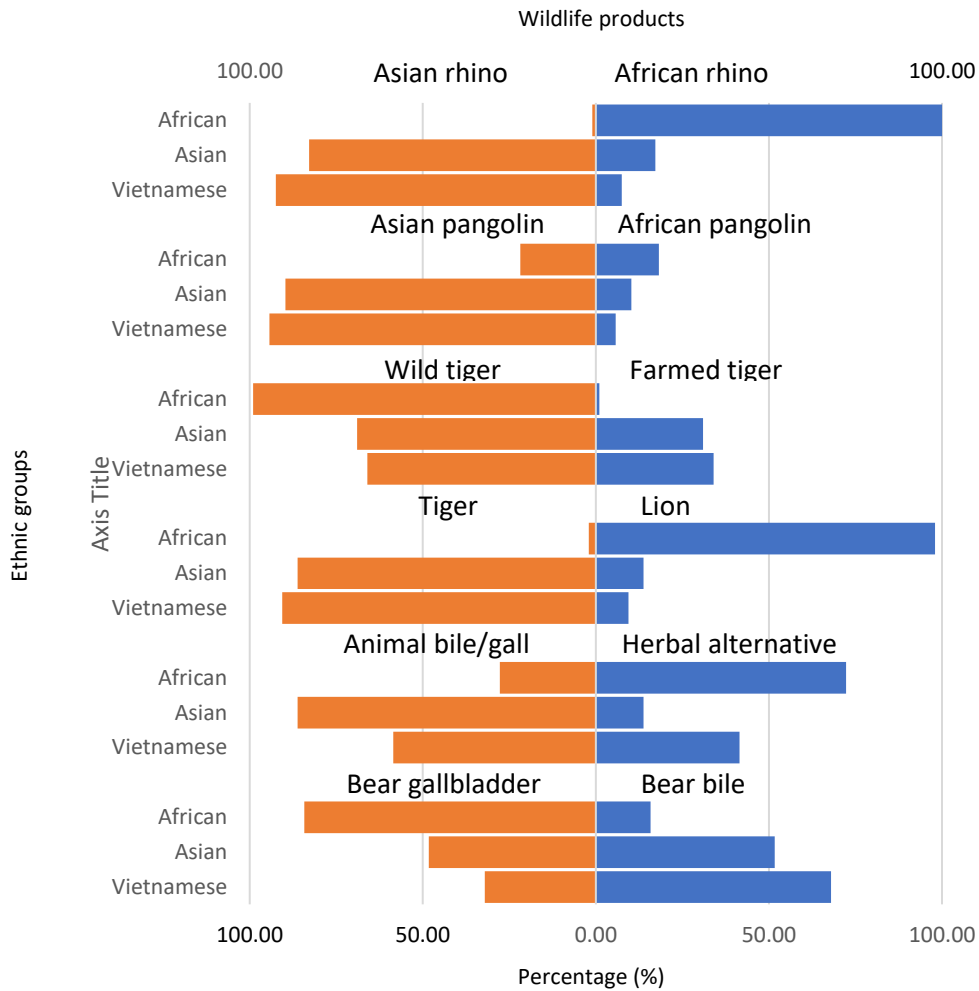
Figure 3.3: Proportion of African *muthi*, Asian and Vietnamese TAM traders and practitioners expressing preference for wildlife ingredients used in traditional medicines, as percentage of total responses.

There is a significant difference in preferences of the geographic origin of wildlife products used in traditional medicines between the respondent groups: African respondents show a significantly greater interest in African pangolin whereas Asian and Vietnamese prefer to use Asian pangolin scales (χ^2=91.628, df=2, *p*=0.001). Similarly, African respondents preferred African rhino horn, while Asian and Vietnamese respondents preferred Asian rhino horn (χ^2=150.320, df=2, *p*=0.001). Given the choice between using lion bone and tiger bone, African respondents also prefer to use lion bone (98.0%) while

86.2% Asian and 90.6% Vietnamese respondents preferred tiger bone (χ^2=141.916, df=2, *p*=0.002) (Figure 3.3).

Although more Asian respondents chose to use TAM treatments rather than Western treatments compared to the Vietnamese and African respondents, no significant difference was found (χ^2=11.889, df=2, *p*=0.020). All three groups prefer to use TAM than *muthi*, however 29.7% of African respondents would choose to use *muthi* whereas the Asian and Vietnamese did not choose to use this treatment (χ^2=41.559, df=2, *p*=0.049). Similarly, no Asian and Vietnamese would choose *muthi* over Western Medicine whereas African respondents still prefer to use *muthi* rather than Western medicine (χ^2=79.048, df=2, *p*=0.040) (Figure 3.4).
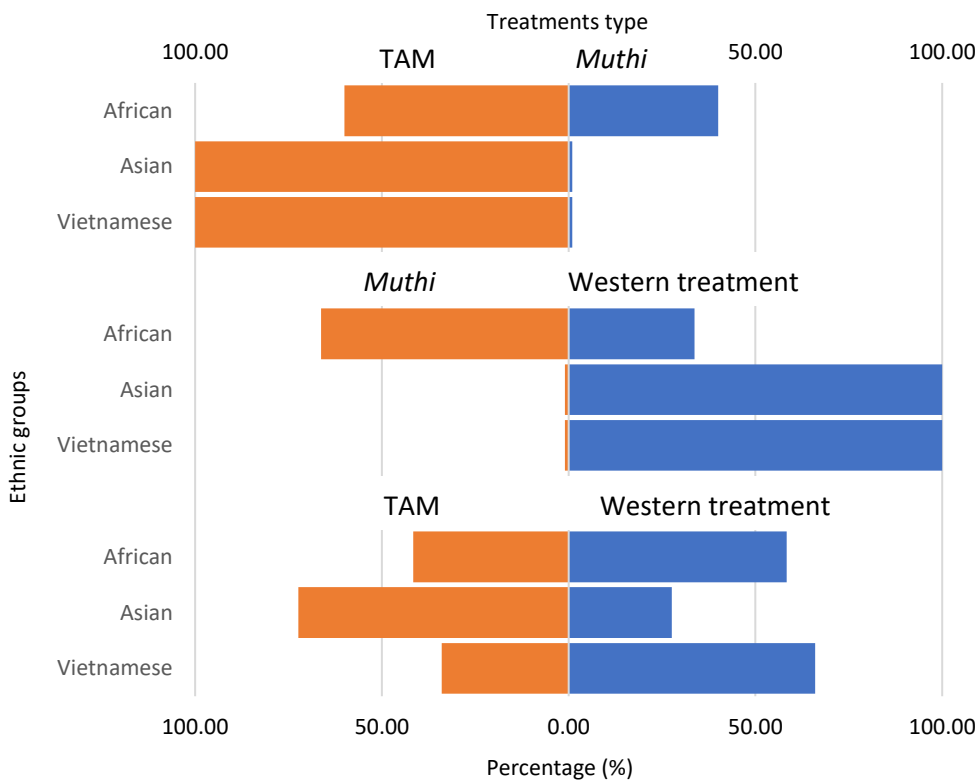
Figure 3.4: Proportion of African *muthi*, Asian and Vietnamese TAM traders and practitioners expressing preference for medical treatment, as percentage of total responses.

Rhino horn was ranked highest amongst wildlife parts according to their medicinal value by all three groups. There was a significant difference between ranking among the three groups for tiger parts (χ^2=83.353, df=2, p<0.001), bear bile/gallbladder (χ^2=78.984, df=2, p<0.001) and pangolin scales (χ^2=87.532, df=2, p<0.001). Specifically, Asian and Vietnamese respondents ranked tiger parts higher than lion (both Asian and Vietnamese mean rank of 125.00 for tiger and 88.00 for lion), bear bile/gallbladder (Asian mean rank of 91.00 and Vietnamese mean rank 48.26 for bear parts) and pangolin scales (Asian 77.00, Vietnamese 128.79) when compared to African respondents (tiger 65.21, lion 95.25, bear 115.24 and 77.00 for pangolin).

There are significant differences in responses attributable to gender and age group when all groups were combined. Female respondents were more likely to choose herbal alternatives over bear bile/gallbladder compared with male respondents (χ^2=42.801, df=1, *p*=0.001). Respondents in the age categories 40 – 64 and 65 – above prefer to use rhino horn than Western medicines (χ^2=16.224, df=4, *p*=0.005). Further, these age groups show a significant preference towards TAMs than Western treatments (χ^2=11.987, df=4, *p*=0.011).

3.5. Discussion

Here we present the first in-depth study into the perceptions of TAM practitioners and traders towards the use of wildlife products in Africa. Further, we provide an understanding as to whether African *muthi* traders and healers accept TAM treatments. Comparing responses from the three sample groups (African, Asian in South Africa and Vietnamese in Vietnam) provided an understanding of the similarities and differences in traditional medicine traders' and practitioners' motivations for wildlife parts use. The results provide an understanding of preferences for TAM products in Africa that contain wildlife animal parts and derivatives and identify target groups for future conservation initiatives.

3.5.1. Values, knowledge and perceptions

We gathered information from the respondents about factors that they considered as most important when selecting TAM for personal healthcare. Traditional value was prioritised by the Asian and Vietnamese respondents, however African respondents indicated that TAM's perceived health benefits, such as long-lasting effects and with no negative side effects, were their main reasons to choose TAM over Western medical treatments. This result may indicate that African traders/healers are interested in the medicinal effects, rather than the traditional and cultural aspects of TAM. Similarly, in a survey of TAM users in Singapore, Tan and Freathy (2011) found that consumers chose traditional medicine for its traditional properties, while in China, Zhang et al. (2013) found consumers valued TAM's cultural and traditional aspects.

In our survey, Asian and Vietnamese respondents were able to name more purportedly medicinal uses of rhino horn than the African group. The uses listed by the Asian and Vietnamese respondents includes reducing fever as well as to treat asthma, rheumatism, and cancer, and as aphrodisiacs whereas the African group were only able to name cancer treatment and use as aphrodisiacs. According to Dinerstein (2016) and Milliken et al. (2012), Traditionally Chinese and Vietnamese Medicine practitioners do not view rhino horn as an ingredient to boost libido, even though this use has been widely publicised by Western media. It is possible that African and possibly some Asian respondents, incorporated these ideas from the media. However, during this survey, one traditional African healer discussed the historical usage of rhino horn, stating:

> "*I personally believe rhino horn does something positive. They wouldn't be butchered for years without any reason. Rhino horn have healing, magic and spiritual powers*".

While all African respondents showed interest in the use of rhino horn for medicine, a small number of Asian and Vietnamese respondents expressed that they do not believe that rhino horn can bring any health benefit and, therefore, they do not consider using rhino horn for TAM. In fact, significantly more African respondents believe rhino horn can cure cancer than those from the Vietnamese and Asian groups. This could be the result of education and awareness raising efforts over the last decade reducing demand in Asia (Olmedo et al., 2017). However, the extent to which these campaigns have led to an actual decrease in the demand for rhino horn as cancer treatment, as opposed to increased response bias due to greater awareness on the negative connotations, requires further research. In terms of campaigns within South Africa, as far as we are aware, beyond national legislation, there is no record of any education or demand reduction projects related to the use of rhino horn for traditional medicines.

While there are documented health risks associated with consuming/associating with infected wildlife (e.g. SARS, Guan et al., 2003; AIDS and Ebola, Liu et al., 2014, Reperant and Osterhaus, 2017), Chinese consumers of TAM tend to believe natural ingredients, such as herbs and animal parts, are safe to use (Liu et al., 2018). Our research has shown a similar pattern, as respondents from all three groups had little concern about the potential of wildlife products transmitting diseases from wild animals to human (Figure.3.2). However, it is noteworthy that when prescribing wildlife products, African respondents were more concerned that they may contain poisons.

The Vietnamese respondents did not consider the use of wildlife products in TAM could be a threat to the local African wildlife, nor that the consumption of wildlife parts could lead to the decline of wild populations. This result mirrors patterns seen in Vietnam through previous research (Drury, 2011, 2009; Nguyen and Burola, 2015; Venkataraman, 2007). However, one might argue that Vietnamese respondents in this survey see the decline of African wildlife as an isolated issue and do not relate it to

their consumption habits as much as Asian and African respondents, who are living in South Africa, and therefore have stronger connection with African biodiversity. Crudge et al. (2018) in their study of bear bile farms found that, although bear bile farmers in Vietnam reported sourcing bears from the wild and reported that local bear populations had become rare or extinct, they did not consider there to be a causal link between the two factors.

Some of the most significant differences found in this study were around the perception of TAM's benefit to the African society. Asian respondents strongly believe that TAM service creates jobs for African people and contributes to the well-being of Africans through healthcare services, whereas African respondents were less likely to hold this belief. It has been widely documented that Chinese contractors tend to employ Chinese workers to perform work overseas, often bringing their own family members and relatives to set up businesses rather than hiring this from the local community (Cook et al., 2016; Isaksson and Kotsadam, 2018; Mohan et al., 2014). During the survey, it was noted that 93.1% of TAM shops run by Chinese and other Asian nationals have Chinese/Asian staff rather than those from the local African community. TAM services may bring some benefits to the local economy through employment of local staff, particularly in harvesting wildlife/herbal products, however the presence of local staff within roles that do not require specialised TAM training, such as receptionists and cashiers, appears to be extremely rare.

Asian respondents in our survey showed significantly higher interest in the cultural value of TAM. However, compared to African and Vietnamese respondents, they are less likely to consider the use of wildlife parts to be an important part of their culture nor that it is essential for traditional medicines. Although Asian respondents prefer to use Asian wildlife products for TAM rather than African wildlife parts, they are less likely to be open to the idea of using rhino horn, tiger bone, lion bone and pangolin scales than respondents from Vietnam and Africa.

All three groups believed bear bile should be available to people to use as medicine. It is noteworthy that African *muthi* practitioners do not have a history in the use of bear parts, and that the Vietnamese and Asian groups, which do have a history of bear part use, are aware that bear bile and gallbladders might still come from wild bears. Results from our survey also show that Vietnamese and African respondents expressed interest in wild bile as they thought it was more potent. The Asian respondents did not show preference toward wild bear bile compared to farmed bile. This could be because they are not interested in, or lack of access to, bear products. Further, this increased preference toward farmed bile within the Chinese diaspora maybe a result of the Chinese government's increased regulation and standardisation of the TCM trade. Consumers may see certified farmed bear bile to be a more consistent product than bile from wild bears. In a survey of Chinese and Lao participants, Davis et al. (2016) found that although there was a belief that bile from wild bears has stronger medicinal properties than bile from farmed bears, there was an understanding that using bile from wild bears will lead to the extinction of bears in the wild. However, given the choice, the Laotian respondents would prefer to use bile from wild bears (Davis et al., 2016). Previous research has suggested that bear bile farming has the potential to create more demand for bear bile than can be satisfied and has the potential to increase the pressure on wild bear population as people are more willing to pay a higher price for wild bear products (Crudge et al., 2018; Davis et al., 2016; Drury, 2009b; Dutton et al., 2011).

3.5.2. Preference and attitudes

Rhino horn was ranked highest amongst wildlife parts in relation to medicinal value by all respondents. Our findings, however, show that different respondent groups have different preference for wildlife products based on geographic origin. For example, Asian and Vietnamese (including those living in South Africa) show a strong interest in using Asian wildlife products, whereas African respondents are more interested in African wildlife (e.g. African rhino horn v Asian rhino horn, lion bone

v tiger bone, African pangolin scales v Asian pangolin scales). These preferences may be influenced by the availability of wildlife parts as well as consumer familiarity with parts traditionally used. In a study of bush meat consumption in Central Africa, East et al. (2005) found that consumer's preference correlated to the availability of wildlife products in the market, suggesting that the more available a product is, the more frequently it is consumed, the greater the consumer preference. Further, Turrell (1998) suggested that in order for preferences to develop, a product must first be reasonably familiar. As the use of TAM becomes more popular in South Africa, there is a possibility that *muthi* practitioners may absorb the use of non-native species used in TAM (e.g. tiger and bear) if the parts and derivatives became more widely available.

Similarly, Asian respondents are more likely to choose TAM and African respondents are more interested in *muthi*. However, African respondents are also more willing to try TAM than Asian respondents are to try *muthi*. Research has suggested that Chinese and Vietnamese tend to think of Africa as an underdeveloped continent with little to offer in terms of technology or medical service (Cheng, 2011; Johnson, 2007; Sautman, 1994). As a result, they may not value *muthi* as much as the African people do. The willingness of African respondents to try TAM could also be due to the availability and familiarity of products. For example, even though both TAM and *muthi* use wildlife products, *muthi* is associated with *voodoo* rather than just its healing effects (Gruca et al., 2014; Mafimisebi and Oguntade, 2010). TAMs have been introduced in South Africa through the settlement of Chinese and Asian populations for decades, while African peoples have only recently started to move to China and other Asian countries (Chen, 2011).

3.5.3 Age and gender

The results showed that older people in the age categories 40 – 64 and 65 and above, from all three groups sampled, are more likely to use rhino horn for health benefits, and preferred TAM than Western medicine compared to younger people. Studies have shown that older people are more likely to use wildlife parts as medicine than younger people, they are also more interested in traditional medicines than modern western medicines (Drury, 2009b; Nguyen and Burola, 2015; Venkataraman, 2007).

Research in Vietnam (Nguyen and Burola, 2015) and China (Tam, 2013) suggested that female consumers might be more empathetic to animals than their male counterparts, thus they are more likely to choose available alternative herbal products than wild animal parts. Our findings also support this, with females being less likely to use products from wild animals than male, and that they prefer to use herbal alternative than animal parts.

3.6. Conclusion

The demand for wildlife products for use in TAM is spreading beyond Asia into other continents such as Africa. With wildlife populations depleted throughout much of Asia, the willingness of TAM traders and practitioners to shift consumption to African substitutes, coupled with an apparent lack of concern or understanding, represents a significant threat to Africa's endangered wildlife. If TAM use increases in African communities, it could have major implications for the persistence of wildlife in Africa. Further, the increase in TAM use and shift to new communities of consumers has the potential to change South Africa from a predominantly "source" country to a significant "consumer" country. Such a shift not only has the potential to impact local wildlife populations, but also opens up the possibility of smuggling wildlife from Asia into South Africa to satisfy the demand for TAM products of Asian origin. The short trade chain from poachers to consumers within South Africa, and the limited opportunity for

law enforcement interventions make demand-side interventions all the more important to the conservation of local populations of trade-threatened species.

3.7. Acknowledgement

Conflicts of interest statement

None

3.8. References

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3.9. Supporting document

<p align="center">Survey instrument</p>

Hello, my name is _____. I am a PhD student from the University of Kent in England and I would like to ask you some general question about the use and trade of wild animal parts in traditional medicine. Your answers are anonymous. I will not record your name and your participation in this study is voluntary. You can refuse to answer any questions or stop the interview at any time if you are uncomfortable.

Please could you confirm that you are happy to participate in this study? If yes, please tick this box ❐

<p align="center">Survey of African muthi, Asian and Vietnamese TAM traders
and practitioners in South Africa and Vietnam</p>

1. Why do you think your customers choose TAM **over other medical treatment**, for example, western or traditional African medicines? (Please rank the following statement, 6 is the most important and 1 is the least important)

❐ Traditional/cultural value

❐ More effective than other treatments

❐ Cheaper than other treatments

❐ Long lasting effect compare to other treatments

❐ No side effects

❐ Personalise (mixture of ingredients according to personal preference and stage of health)

2. Below are statements representing different ways that **people might think about Traditional Asian Medicines (TAM)**. We're interested in knowing your views about TAM. Circle one number for each *statement.*

		Disagree	Neither	Agree
a	TAM is beneficial to local people through medical service	1	2	3
b	TAM is beneficial to the local economy by creating employment and increasing trading products with local people	1	2	3
c	TAM is threatening local wildlife by consumption of its wildlife parts	1	2	3

3. For *each* of the following statements, indicate whether **you believe** it is "True", "False", or "Don't Know." *(Please circle your response for each statement.)*

		True	False	Don't know
a	Wild animal parts are essential in Traditional Medicines	T	F	DK
b	In Traditional Asian Medicine, lion bone is a valid alternative to tiger	T	F	DK
c	In Traditional Asian Medicine, rhino horn can cure cancer	T	F	DK
d	In Traditional Asian Medicine, most bears bile and gallbladders come from farmed bears	T	F	DK
e	In Traditional Asian Medicine, Asian pangolin scales have similar effects in treating illness	T	F	DK

4. We are interested in learning **your views** on wildlife products used in Traditional Asian Medicines

Please indicate if you agree or disagree with the following statements. (Circle response)

	Disagree	Neither	Agree	Don't know

a	Wild animal parts are effective in treating disease	1	2	3	DK
b	Bile from wild animals have stronger medicinal properties than bile from farmed animals	1	2	3	DK
c	It is easy to find places to buy wild animal parts for Traditional Asian Medicine uses in Africa	1	2	3	DK
d	African wild animal parts can be used as alternatives to Asian wild animal parts in Traditional Asian Medicine	1	2	3	DK
e	The use of wild animals' part as medicine is an important part of my culture	1	2	3	DK
f	Using wild animal parts will lead to the decline of wild animal populations	1	2	3	DK

5. Below are statements representing different ways that **people might think** about the use of wildlife products in Traditional Asian Medicines (TAM). We're interested in knowing *your* views about <u>TAM.</u> (Circle one response)

		True	False	Don't know
a	I think rhino horn should be available for medical treatment	T	F	DK
b	I think tiger bone should be available for medical treatment	T	F	DK
c	I think lion bone should be available for medical treatment	T	F	DK
d	I think pangolin scale should be available for medical treatment	T	F	DK
e	I think bear gall and bile should be available for medical treatment	T	F	DK

6. What is **your greatest concern** when prescribing wild animal parts to be used in Traditional Asian Medicines (Please rank the following statement, 5 is the most important and 1 is the least important)

❐ Poison

❐ Extinction of endangered wild animals

❐ Fake products

❐ Transmission disease from wild animals to human

❐ Violating the law (if consume protected species)

7. If you or your customers were ill, which of the alignment would you consider **using rhino horn to treat**? *(Please tick one box)*

❐ Asthma   ❐ Cancer

❐ Aphrodisiac   ❐ Rheumatism

❐ Fever   ❐ Other (please specify)_____

8. If you have to prescribe one to your patient, which of the following do **you prefer to use** as traditional medicine's ingredient? *(Please tick one box in each pair)*

❐ Bear bile	OR	❐ Bear Gall-bladder
❐ Bone from wild tiger	OR	❐ Bone from farmed tiger
❐ Asian pangolin scale	OR	❐ African pangolin scale
❐ Tiger bone	OR	❐ Lion bone
❐ Asian rhino horn	OR	❐ African rhino horn
❐ Wild rhino horn	OR	❐ Farmed rhino horn
❐ Bear bile/gall-bladder	OR	❐ Herbal alternatives
❐ Rhino horn	OR	❐ Western Medicines
❐ Western Medicines	OR	❐ Traditional Asian Medicines
❐ Traditional Asian Medicines	OR	❐ Traditional African Medicines

❒ Traditional African Medicines   OR   ❒ Western Medicine

9. Please rank the following wild animal's body part according to **their medicinal value**. 5 is the most valuable and 1 is the least.

❒ Tiger bone

❒ Pangolin scale

❒ Bear bile/gall bladder

❒ Lion bone

❒ Rhino horn

10. In closing, we would like to ask you for the following demographic information to help us make general conclusions regarding the views of Traditional Medicine traders and practitioners. Your responses will remain **completely confidential**.

a. What is your gender? ❒ Male   ❒ Female

d. What is your nationality?
_____

b. What is your age?   _____ years

e. What is your ethnicity?
_____

c. What is the highest level of education you have completed?

❒ None

❒ Primary school

❒ Secondary school/High school

❒ College/University

❒ Masters/PhD

Chapter 4

Growing demand for wild animal parts use in

Traditional Asian Medicine in South Africa

4.1. Abstract

Traditional Asian Medicine (TAM) has been promoted as a key pillar of the China's Belt and Road Initiative (BRI) in 2017. South Africa is a significant beneficiary of the BRI development, and it is also home to the largest Chinese population in Africa. Using South Africa as a case study, this paper aims to provide an understanding of how the promotion and proliferation of TAM through expansion of the BRI might impact local African wildlife. We interviewed 1,476 TAM users across the four largest cities in South Africa, namely Cape Town, Durban, Johannesburg and Pretoria. Our results suggest that wildlife parts are widely used as TAM ingredients in South Africa by several groups of people, including the "new" migrant Asian people, the long-term settled Chinese African, and particularly the local African people. There is a strong belief ingrained in both Asian and African TAM users in the power of consuming wild animal parts as medicine. While the African people prefer using local species for TAM practice, non-native species, such as tigers and bears are also used in South Africa and preferred by the Asian and Chinese African consumers. Legislative weakness in South African creates opportunities for this illegal trade and consumption of non-native species to continue. To prevent biodiversity loss, it is important that the promotion and adoption of TAM is conducted in a responsible manner with an emphasis on long-term sustainability and that it includes standards for monitoring and regulating the ingredients used.

Keywords: diaspora, demand, illegal wildlife trade, illegal wildlife consumption, immigration, Asian migrants

4.2. Introduction

In 2013, China announced its ambitious Belt and Road Initiative (BRI) based not only on the development of a physical infrastructural route, but also Chinese practices intended to increase China's involvement in international development. The BRI covers over 65 countries in Asia, Africa, Europe and South America in the initial phases which includes over 60% of the world's population (The World Bank, 2018). The BRI has two major components: The Silk Road Economic Belt (covering terrestrial economic corridors connecting China to the rest of the world) and the Maritime Silk Road (running from China's border with the East Sea to the Indian Ocean and the Mediterranean). A briefing paper produced by the Worldwide Fund for Nature (2017) demonstrated an overlap between BRI projects and sensitive environment areas, threatening at least 1,739 Important Bird Areas and Key Biodiversity Areas. Expansion of such transport networks are likely to lead to increased habitat destruction and illegal extraction of resources in these areas (Hughes, 2019), in addition to increasing vulnerability of surrounding regions and increasing access to formerly inaccessible areas.

A key pillar of BRI is the promotion of Traditional Chinese Medicine (TCM) (Hu et al., 2017). In January 2017, China signed a Memorandum of Understanding with the World Health Organisation (WHO) to promote health security on the Belt and Road Initiative (Wu, 2017). Seven months later, the first high-level Belt and Road's health conference was hosted in Beijing, with more than 30 health ministers and leaders from around the world signing the Beijing Communique to increase BRI's health exchange and cooperation (Tiezzi, 2017). In 2018 in its leading global medical compendium, the WHO noted the role that TAM plays in global healthcare and predicted an increased spread of TAM practices globally (Cyranoski, 2018; Khandekar, 2019; Reddy and Jacobs, 2018). Similar to many other forms of medicine, TAM includes products formulated from both domestic and wild animal parts, including endangered species (Crudge et al., 2018; Nowell et al., 2011; Milliken and Shaw, 2012). Although the use of products from some endangered wildlife has been prohibited, this is often not enough to prevent

trade or reduce demand. Tiger farms to produce tiger-bone wine have continued to operate despite the export of these products being in contravention of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (EIA 2013). The use of tiger bone has been banned in China since 1993 and it was removed from the list of approved TCM ingredients (Mills and Jackson, 1994), however poaching of wild tigers for this purpose continues (Nowell, 2011). Over a 22-year period (1994 – 2016), 1,110 tigers and over 4,300 leopards were killed by poachers in India (The Wildlife Protection Society of India, 2017). In a report by The Wildlife Protection Society of India (2017), TAM consumption was found to be the main reason for the poaching. As a direct consequence of demand, all 8 pangolin species are at a heightened probability of extinction and the group is reported to be the most trafficked mammal globally (Ingram et al., 2018). In 2016, all pangolin species were listed on Appendix I of CITES, thereby prohibiting all international commercial trade (Gaworecki, 2016). However, within the first six months of 2019, a remarkable 61.3 tonnes of African pangolin scales – an ingredient in TAM – were seized at several ports on the Maritime Silk Road in Asia (Singapore: 39.6 tonnes (Devaraj, 2019; Liu, 2019), Hong Kong: 9.0 tonnes (Chow et al., 2019), Vietnam: 12.7 tonnes (Doom, 2019; Vu et al., 2019).

The expansion of the Maritime Silk Road and Belt and Road Initiative, with promotion of TAM as a key tenet, increases trade connectivity between Africa and China and may create an opportunity for wildlife trafficking, particularly for high value wildlife products such as those used in TAM. Although traditional medicines have many benefits, without rigorous checks, controls and standards, such as the Fairwild standards (Fairwild Foundation, 2019), it also pose a risk. As such, the growing use of TAM without the development of adequate monitoring poses a significant threat to wildlife. With growing connectivity fuelling increased trade and interaction between regions, mechanisms are needed to ensure the continued survival of wildlife.

South Africa is a significant beneficiary of Chinese investment and the development of the BRI to promote development along the route (Mhlanga, 2018). Nine Chinese companies committed to investing more than 10 billion USD into the Musina-Makhado Special Economic Zone (SEZ) in Limpopo, South Africa (African News Agency, 2018). The Chinese population of permanent and temporary residents in South Africa has therefore increased dramatically, expanding the market for traditional Chinese products, as well as a route of further interchange of products between the two regions. The exact number of Chinese workers that have arrived in South Africa due to the development of the BRI and SEZ projects is unclear, however China has been criticised for only employing Chinese workers to perform work overseas (Cook et al., 2016; Isaksson and Kotsadam, 2018). South Africa is also home to fourth or fifth generation Chinese African people (Hall, 2013; Kushner, 2013; Park, 2008) and continues to be a destination for Chinese immigrants (Park, 2012).

Using South Africa as a case study, we analyse TAM consumers' attitudes towards various medical treatments (i.e. Western Medicine, Traditional African Medicine and Traditional Asian Medicine) and whether they value the use of wildlife parts in TAM. We explore their knowledge and preference towards the use of wildlife parts in TAM; determine how it might contribute to the illegal trade and consumption at national and international levels; and determine which factors influence choice of treatment. In this study, we focus on medical products made from rhino, tiger, bear, pangolin and lion, given their endangered status and popularity in TAM (Ellis, 2005). To our knowledge, this is the first study providing a detailed analysis of TAM consumers in Africa in general and South Africa in particular. The aim of this paper is to provide an understanding of how the promotion and proliferation of TAM around the world, through expansion of the BRI and establishment of local Chinese populations, might impact local wildlife.

4.3. Methodology

The study received ethical approval from the Research and Ethics Committee of the School of Anthropology and Conservation, University of Kent.

4.3.1. Study areas

Study sites were chosen focussing on large cities with large Asian populations; Johannesburg, Pretoria, Durban and Cape Town (Park and Rugunanan, 2008). A recent study (Chapter 2) showed that TAM shops were concentrated in these large cities.

With consent from TAM shop and clinic owners, we approach customers opportunistically and explained that we were studying knowledge, attitudes and preferences for TAM in South Africa. We informed them that taking part in this survey was voluntary and they could refuse to answer any questions or stop the survey at any time. Respondent's consent was recorded by ticking a box on the questionnaire datasheet.

Local assistants were recruited at each city to accompany the researcher and were divided in teams to carry out the survey. At least one Mandarin and/or Cantonese speaker was present at every interview with Asian respondents.

4.3.2. Survey strategy

Surveys were carried out in South Africa between the 20th April and the 2nd October 2017. A pilot survey was carried out from the 10th to the 15th March in Johannesburg with 15 TAM users to test the survey instrument. Adjustments were made based on the results of this pilot survey and after consultation with social science experts. Local research assistants participated in two-day training courses to practice survey skills, record and input data.

The survey instrument was divided into several sections. Prior to the start of the survey, the concepts of "wildlife farming" and "cancer" were explained to the respondents (Supplement documents), and a picture of each focused species was shown to respondents to avoid confusion. Demographic information of the respondents was recorded (e.g. gender, age, nationality), followed by a section focused on their attitude towards wildlife parts used in traditional medicine, and their preferences and knowledge toward these products Potential interviewees were also informed that their participation was voluntary and they can refuse to answer any questions or stop the interview at any time if they feel uncomfortable. Their responses are anonymous and will be used for a PhD research purpose only.

To understand the factors influencing their choice of treatment, we asked respondents a series of questions based on five- and six-point scales. We asked respondents which factors are the most important for them when choosing TAM. Respondents were asked to choose their preferences between farmed wild animal or wild animal parts, and Asian or African species. It should be noted that 'no preference' was not provided as an option.

4.3.3. Data analysis

Data analysis was conducted in R 3.4.1 software program (R Core Team, 2017). Chi-square test was used for association between nationalities, genders and age-groups with responses to questions on the use of wildlife parts in traditional medicine. Kruskal-Wallis non-parametric test was adopted to analyse data from ranking questions. Following a Shapiro-Wilk test of normality, a 2-way ANOVA analysis was used to investigate the relationship between consumers' age and their consumption behaviour. In cases when the results where significant, a Tukey post hoc test was applied. To analyse the use of wild animal products in TAM, respondents were grouped into users and non-users, based on their self-declared answer. Results are considered significant with 95% confidence intervals (p value <0.05).

4.4. Results

4.4.1. Demographics of TAM users

Table 4.1: Demographics of TAM users in Johannesburg (n=600), Durban (n=441), Pretoria (n=225) and

Cape Town (n=210).

Location	Gender		Age Range Average	Education Common Highest level	Occupation Most common
	M	F			
Johannesburg	349	251	20-96 40.0	Bachelor degree 76.33% (n=458)	Freelance/ Self - employed 34.0% (n=204)
Durban	272	169	24-78 39.1	Bachelor degree 70.74% (n=312)	Freelance/ Self - employed 42.2% (n=95)
Pretoria	145	80	22-79 37.9	Bachelor degree 66.67% (n=150)	Freelance/ Self - employed 35.6% (n=157)
Cape Town	112	98	25-76 35	Bachelor degree 90.00% (n=189)	Freelance/ Self - employed 30.0% (n=63)

A total of 1,476 TAM customers participated in this survey from 29 TAM shops and clinics in

South Africa. Of the respondents, 42.4% were local African (n=625), 44.9% were Chinese-African

(n=662), 10.6% were from East Asia (e.g. China, Taiwan, Vietnam, etc.) (n=156), and 2.3% were from

other locations, such as Pakistan and Brazil, hereafter referred to as others (n=33). Further, 59.5% were

male (n=878) and 40.5% were female (n=598). Bachelor's degree was the most common highest

education level (75.1%, n=1,109), and 39.7 years was the average age (age range: Male: 20-93; Female:

20-89). Demographic information for each survey site is summarised in Table 4.1.

Table 4.2: Wild animal's parts users of TAM in Johannesburg, Durban, Pretoria and Cape Town.

City and ethnic group	Non-user		User				Total
	Male	Female	Male		Female		
			1-10*	>10*	1-10*	>10*	
Johannesburg							
a. Local African	41	83	13	12	42	5	196
b. Chinese African	130	82	52	13	9	2	288
c. Asian	43	15	20	4	3	1	86
d. Others	3	6	1	2	0	1	13
Durban							
a. Local African	133	45	45	8	17	2	250
b. Chinese African	64	77	5	0	5	2	153
c. Asian	10	15	2	0	2	0	29
d. Others	2	1	0	0	0	0	3
Pretoria							
a. Local African	68	25	17	7	5	0	122
b. Chinese African	44	34	5	1	3	2	92
c. Asian	5	9	0	0	0	0	14
d. Others	4	2	1	1	0	0	8

Cape Town							
a. Local African	27	6	8	0	2	0	43
b. Chinese African	58	69	2	0	5	0	134
c. Asian	13	12	1	0	0	0	26
d. Others	3	4	0	0	0	0	7

*The number of consuming wild animal parts over the last 12 months.

4.4.2. Factors influencing choice of treatment

A majority of TAM users (81.9%) stated that most medicine practitioners they know prescribe western medicine. Most of them (70.4%) also reported that people closest to them had used wild animal parts as medicine, and 68.2% stated that these people believe they should also use wild animal parts for medical purposes.

The most frequent reason stated by users for choosing TAM over other medical treatments is that TAM is believed to have no side effects (39.4%, n=582), whereas price was the least frequently stated reason (0.4%, n=6). One local African TAM user stated:

"TAM is not cheap, especially if you buy medicines made of ingredients imported from Asia. I prefer to use TAM as it does not give any side effects like western medicine does. My aunt took western medicine for years, and then one day she cannot urinate. She went for a scan and they found a huge lump of pills stuck together in her stomach. Your body cannot digest pills made by western medicine. Our traditional African medicine is dangerous, the sangoma [traditional healers] have [voodoo] powers and they can harm you with their magic."

Most respondents did not have any concerns about using wild animal parts in TAM (45.7%, n=673). However, some (39.8%, n=586) stated that they were worried about accidentally purchasing fake products, and some (8.8%, n=130) about being poisoned if they consumed the products incorrectly. Only 3.1% (n=46) reported that they were worried about the legality of the wild animal parts used in

TAM, and 2.1% (n=31) were concerned that wild animals might go extinct if consumption was unsustainable. Only 0.5% (n=8) were worried about contracting diseases transmitted through consumption of wild animal parts as TAM (Figure 4.1).
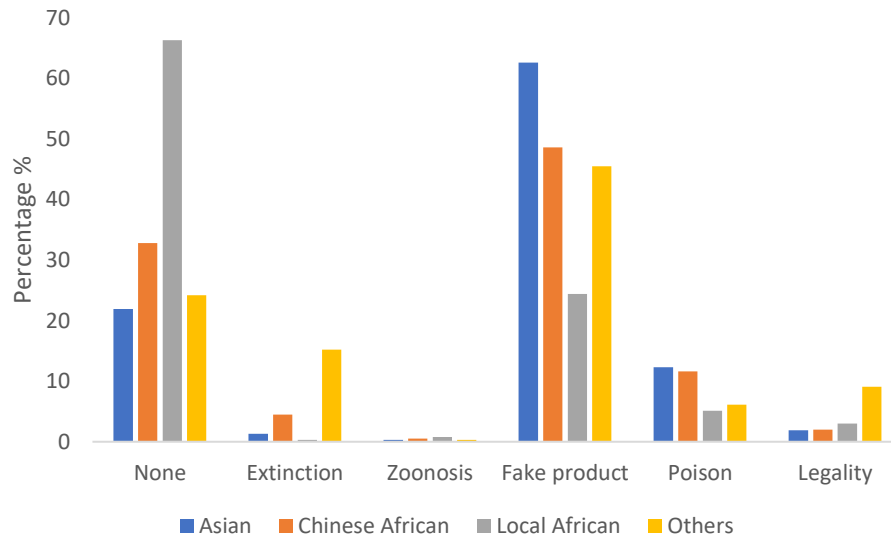
Figure 4.1: Respondents' concerns when consuming wild animal parts in TAM in different ethnic groups: Asian, Chinese-African, Local African and others.

4.4.3. Knowledge and use of wildlife parts in TAM

There was a statistically significant association between respondent groups and the importance they place on the use of wildlife parts in traditional medicine (χ^2=55.988, df=2; p=0.001). The number of respondents that admitted to consuming wild animal parts as medicine was also significantly different between local African, Asian and Chinese African respondents (χ^2=46.714, df=2, p=0.002). The number of self-admitted users varied greatly between four cities (χ^2=29.512, df=2, p<0.001).

Significant differences were found between locations and the frequency of use of wild animal parts over the last 12 months (Kruskal-Wallis, H=50.475, df=3, p<0.001). Among those who self-declared

to consume wild animal parts as TAM, 22.2% (n=40) of consumers from Johannesburg reported using wild animal parts as medicine more than 10 times over the last 12 months, compared to 13.6% respondents (n=12) from Durban, 31.1% (n=14) from Pretoria and zero from Cape Town. Use by genders varied greatly, with males consuming wildlife products more than females (χ^2=21.019, df=1, p= 0.001). There was also a significant interaction between the effects of age and education level on the use of wild animal parts in TAM (F=3.124, df=3, p=0.025). A post-hoc Tukey test showed that there were significant differences in the use of wild animal parts between people whose highest level of education were primary school and high school (p<0.001), high school and bachelor degree (p<0.01), high school and post-graduate (p=0.024). Highly educated people are less likely to consume wildlife for traditional medicine than groups educated to a lower level.

The use of rhino horn for treatment varied substantially between respondent groups (χ^2=519.763, df=15, p<0.001). This is mostly because most local Africans only named two uses of rhino horn in TAM: as aphrodisiac (62.4%) and cancer treatment (17.8%). Whereas Asian and Chinese African respondents named more treatments using rhino horn, including treatments for fever, asthma, cancer and others (Figure 4.2).
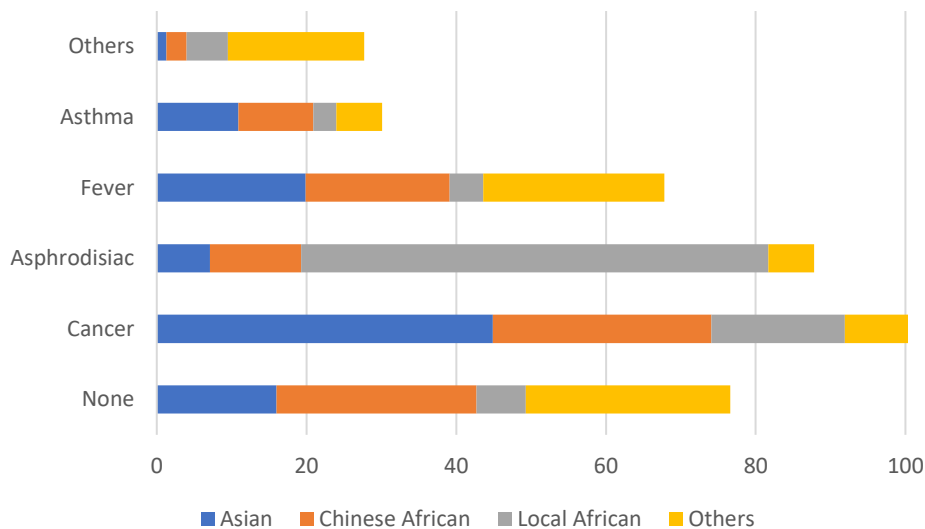
Figure 4.2: Percent of respondents identifying conditions and uses that rhino horn is considered to be effective in treating, as identified by Asian, Chinese African, local African and other TAM users in South Africa.

One Asian TAM user stated the use of rhino horn for cancer treatment is not medically correct:

"My grandfather was a TAM doctor and he said any doctors who use rhino horn for cancer treatment are wrong. They do not understand the difference between abscess caused by heat and toxic body fluid and tumour caused by cancer. You can use rhino horn to treat abscess but not cancer."

The use of wildlife parts was significantly different between different ethnic groups and age groups (F=63.314, df=3, p<0.001). Tukey test showed that there were differences between local African and Chinese African (p<0.001), and Chinese African and Asian (p<0.001). Results from a two-way ANOVA also showed that there was a statistically significant interaction between the effects of age and education level on the use of rhino horn (F=4.093, df=1, p<0.001). Tukey tests showed that there were significant differences between those who completed primary school and high school (p<0.001), high school and bachelor (p<0.001), high school and post-graduate (p=0.027) on the use of rhino horn. However, there was no significant difference recorded between bachelor and post-graduate education level. Young and highly educated are less likely to believe rhino horn has any medical effects compared to the older and less educated peoples. However, elder respondents were less likely to believe rhino horn can be use either as aphrodisiac or cancer treatments.

4.4.4 Perceived efficacy of products

Asian and Chinese African TAM users often stated that Asian wild animals are better to use for medicinal purpose than African wild animals, which are better for making souvenirs, because:

"Asian wild animals living in the forest, thus there are more potent herbs for them to consume. Their parts, for example, the horns of the [Asian] rhino are smaller than those in Africa, but they have more medicinal values, because all the goodness has been compacted in there. The African rhino just eats grass, their horn grows faster and bigger, but it has less value for medicine."

However, one African TAM user had a different way of explaining their preference:

"Our African animals are bigger and stronger than those in Asia. It is better to use them as medicine than Asian species. You can use smaller amount, but it gives the same effect".

Bonferroni correction recognised significant difference at 0.007 (0.05/7) for the following statistics. Results from this survey showed that Asian and Chinese African respondents prefer Asian rather than African wild animal parts (Asian pangolin scale: χ^2=443.193, df=1, p<0.001; Asian rhino horn: χ^2=302.748, df=1, p<0.001) compared to local African respondents. This pattern was also seen in their preference for tiger bone over lion bone (χ^2=168.867, df=1, p<0.001).

Asian and Chinese African respondents were more likely to choose farmed over wild animal parts (bear: χ^2=347.716, df=1, p=0.001; tiger: χ^2=354.565, df=1, p=0.001) in comparison to local African respondents. However, Asian and African TAM users were more likely to choose wild rhino horn over farmed rhino horn (χ^2=52.274, df=1, p<0.001). One Asian TAM user suggested that he preferred to buy farmed wild animal parts for medicine, if he can be at the farm to witness the part being extracted from the animal, due to concern about fake products:

"People advertised that they have wild animal parts all the time. But you never know if it's real or not. Real here is not only if it is from a wild animal, but also if it is what they say it is. I have seen many dried pig bladders [gallbladders] falsely advertised as [that of] wild bears. This is Africa, where can they find bears?"

However, when asked to choose between bone from farmed tiger or wild lion, Asian and Chinese African respondents switched from tiger to lion. A significant difference was found in this shift between these choices (χ^2=325.136, df=1, p<0.001), with 70.5% Asian respondents chose tiger previously reduced to 57.1% and 64.8% Chinese African chose tiger reduced to 51.4%.

4.5. Discussion

4.5.1. The users of TAM in South Africa

Our results suggest that wildlife parts are being use as TAM in South Africa by several groups of people, including the "new" migrant Asian people, the long-term settled Chinese African, and particularly the local African people. Previous research has shown that 72% of local South African people use traditional medicines (Ekor, 2014), due to lack of access to western treatments and the fact that traditional medicines are cheaper (Mander et al., 2007). However, we found that most TAM users that participated in this survey know western medicine practitioners and pricing was not a factor that contributed to TAM users' choice of treatment. The primary motivation for using TAM is that individuals believed TAM does not have any side effects and the effectiveness was believed to be longer lasting in comparison to other medical treatments. This belief may be reaffirmed by the fact that substandard and ineffective versions of western medicines are frequently exported to developing countries. These products have a high chance of failing to adequately treat disease, whilst frequently having side-effects (Eban, 2019). Spiritual elements were also mentioned by local African TAM users, citing that they were afraid of the *voodoo* elements associated with traditional African medicine treatments.

Users of TAM in South Africa are often highly educated, with the majority having a bachelor's degree. The local African TAM users who consume wildlife parts as medicine are younger than those from other groups. Generally, these results show that TAM is widely accepted by the local African people in South Africa, including young and highly educated people. Whereas wild animal parts have

been known to be more popular among the elderly than young people in Asia (Drury, 2011; Davis et al., 2019), we found that young local African people are more open to using wild animal parts in TAM than their Asian and Chinese Asian peers in South Africa. This could be influenced by familiarity with wild animal parts, as they are also used in traditional African medicine (Ellis, 2005; White et al., 2004). In addition, more male TAM users use wild animal parts as medicine than female TAM users, which may be related to a belief among young African respondents in the aphrodisiac power of some wildlife parts.

4.5.2. Consumer preference and motivation

East et al. (2018) argued that availability of wildlife parts, as well as consumer familiarity with parts traditionally used, may influence consumer preferences. However, in this study, we found that both Asian migrants and Chinese Africans living in South Africa for generations still prefer to use wild animal parts that originated from Asia rather than Africa, regardless of the availability (e.g. lion bones are more available in South Africa but less preferred than tiger bones). It was argued by Asian TAM users surveyed that because Asian wild animals eat more potent herbs and they are smaller in size; their parts hold higher medical value. Conversely, African TAM users stated that African species are larger and stronger, therefore they are more powerful in treating illness. While the effectiveness of wild animal parts (e.g. rhino horn, tiger bone and pangolin scales) used in TAM remains largely untested, it is reasonable to conclude that consumer's motivation in choosing certain wild animal parts is a complex process and might not be directly related to actual medical efficacy.

We found a similar pattern to previous research in Asia (Drury, 2011; Davis et al., 2016) in the African consumers' preference toward wild animals over farmed wild animal products. However, contrary to what is typically found in Asia (Crudge et al., 2018; Dutton et al., 2011), the Asian and Chinese African groups surveyed in South Africa stated that they prefer to use farmed tiger and bear products rather than those from the wild. We found that individuals were concerned about the

authenticity of supposedly wild animal parts used in TAM and therefore would rather purchase products from farmed animals in order to ensure that it was genuine. However, when given the choice of farmed tiger bone and wild lion bone, Asian and Chinese African TAM users shifted toward the wild option. This could suggest TAM users strongly believe in the power of wild animal over farmed wild animals and that the concerns about the authenticity of the product are allayed by the abundance of the species and presumed availability of genuine products. Wild tigers are rare and fake products are commonly found in trade (Williams et al., 2015).

One of the five criteria identified by Tensen (2006) in order for wildlife farming to benefit species conservation is that consumers must show no preference toward wild-caught animals. In this study, we found wild rhino horn was strongly preferred over farmed rhino horn among the participating TAM users in South Africa, across all ethnic groups. This appears to support the argument against opening the domestic trade in rhino horn, as TAM users showed a preference towards wild rhino horn rather than farmed products. Furthermore, with strong preference for Asian rhino horn by TAM users, allowing the trade of rhino horn could increase the consumer base and thereby put more pressure on the fragile populations of the Asian rhinos.

4.5.3. Legislation

The National Environmental Management Biodiversity Act (NEMBA), promulgated in 2004, is South Africa's main wildlife law, providing the broad framework for wildlife protection in South Africa. It is implemented by a suite of regulations, such as the Threatened or Protected Species Regulations (TOPS Regulations) that establishes a list of species that are threatened or in need of national protection. NEMBA aims to prohibit international trade and transit or transhipment of specimens of species listed in the Appendices to these Regulations, beside those provisioned in CITES; South Africa has been a member of CITES since 1973.

Tiger (*Panthera tigris*) and bear (*Ursidae*) are not native to South Africa and are listed on CITES Appendix I. Market surveys of TAM shops and clinics in South Africa have shown TAM products with ingredients listed from Asian species such as tigers and bears were found across South Africa (Chapter 2). Our findings confirm that there is a demand for tiger and bear products in South Africa, and this use has become established among local African TAM users. However, the TOPS regulation does not include a list of endangered non-native South African species, such as bears and tigers. Legislative weakness in South African creates opportunities for this illegal trade and consumption of non-native species to continue. CITES regulation can be applied if products are seized at the borders, however once in the country, officers may be confused as to how the domestic trade in these products fits within the national legislation (D. Wessie per. comm., July 2017). These legislative weaknesses undermine the power of CITES and are exploited not only in South Africa but also Asia, as is the case with unregulated domestic trade in African elephant ivory in Cambodia (Nguyen and Frechette, 2017). This illustrates the difficulties faced in relying on law enforcement alone in combatting illegal wildlife trade and highlights the importance of demand-side interventions. Increases in the connectedness between African countries, and African and Asian countries with insufficient screening measures could exacerbate these issues by increasing the ability for trafficked wildlife to enter countries, especially without an increase in the capacity of existing customs checking facilities.

4.5.4 TAM impact on biodiversity in South Africa

A key tenet of China's Belt and Road Initiative is the promotion of TAM use in the participating countries. The threats posed by demand for wildlife products for use in TAM and the negative impacts that has had on wildlife populations has been well documented in Asia (Crudge et al., 2018; Stoner and Pervushina, 2013). This study reveals a willingness among local populations to adopt TAM practices. There is substantial demand for TAM within the Asian and African communities in South Africa. The

majority of TAM users (between 65 and 85%) believe that wildlife parts are essential in traditional medicines. A large proportion of local African respondents reported regular consumption of wildlife as TAM. Up to 39% of TAM users surveyed reported using wild animals' parts as TAM, and up to 22% reported using wild animal parts as medicine more than 10 times over the last 12 months. The high prevalence of use and high frequency of use among consumers of TAM should raise concerns as to the sustainability of the practice. To prevent biodiversity loss, it is important that the promotion and adoption of TAM is conducted in a responsible manner with an emphasis on long-term sustainability and includes standards for monitoring and regulating constituents used.

4.5.5. Comparisons to the rest of the African Continent

Here we use South Africa as an example of the persistent use of TAM in citizens with Asian heritage, and the perceived efficacy of wild rather than farmed wildlife. Yet South Africa is representative of the trends across the African continent where increased investment in infrastructure has resulted in an increase in peoples of Asian heritage, including over 1 million Chinese nationals in countries across the continent (Liao & He 2015), making up to 10% of the population in some countries (Poston & Wong 2016). In addition, often due to the fear of local African medicine practices, such as voodoo, there has been uptake of TAM by African populations. The BRI represents a step-change in the ability to transfer resources between Asia and Africa through the creation of new roads leading directly to ports (Damania et al., 2005), and cutting the need for ships to circumnavigate the Malay-Peninsula to reach ports in China. New roads across the continent have already been implicated in the significant increase in hunting pressure, and a decrease in the population of species perceived as high value (Abernethy et al., 2013). Therefore, the cultural and historical similarity of countries across the African continent will show the same patterns to those highlighted here, and should be similarly managed to allow citizens to experience the benefits of TAM without the risk to native species in Africa and Asia.

4.6. Conclusions

It is clear that the practice of TAM is well-established in South Africa, including the use of some non-native species, such as tigers and bears. While Asian and Chinese African consumers of wild animal parts in TAM are mostly elderly, local African consumers are young and highly educated people. This source of consumer demand for wild animal parts may pose a serious threat, not only to native African species such as lions and rhino, but also to other species that are being used as substitutes. The results demonstrate that there is a strong belief ingrained in TAM users in the power of consuming wild animal parts as medicine across all respondent groups. The use of rhino horn as medicine in TAM varies between different groups. For example, older TAM users are more likely to use rhino horn to cure minor sicknesses such as fever, whereas young people tend to believe rhino horn is a treatment for cancer. This suggests that behaviour change interventions that focus on a single source of demand (e.g. rhino horn for cancer treatment) will not resonate universally, and that specific approaches are required.

The adoption of TAM is being promoted as a key component of China's Belt and Road Initiative, and there is established demand for TAM not only in Asia but also Africa. To ensure that TAM use does not have negative impacts on biodiversity, collaborative efforts between organisations and relevant stakeholders (such as WHO, the Association of Traditional Chinese Medicine, scientists, government bodies) are needed in order to tackle the illegal wildlife trade and consumption. Effort should be made from TAM doctors to inform users on the legality and effectiveness of wild animal parts used in TAM, as interventions need to be addressed from both supply and demand side to tackle the illegal trade of wildlife products (Veríssimo and Wan, 2019; Wallen and Daut, 2018; Willemsen and Watson, 2018), and find sustainable alternatives to threatened species. Further research into use for specific wildlife products is required in order to identify target audiences and design effective behaviour change interventions.

Poorly regulated trade undermines South Africa's ability to preserve its natural resources through exploitation of legislative weaknesses, laundering of illegal products, and ineffective law enforcement. Enactment of stricter laws concerning the international and domestic trade of threatened species, should be considered, and it is important to tackle weaknesses within policies and better regulate the wildlife trade market to ensure sustainable traditional medicine use. Finally, China should aim for consistent messaging around its future vision of ecological civilisation. This cannot be implemented without including how its vision can be translated in a world where it will play an increasing role as a driver of global change.

4.7. Acknowledgements

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4.9. Supplement documents

Survey instrument

Before starting the survey, we would like to ask you for the following demographic information to help us make general conclusion regarding the view of TAM users in South Africa. Your responses will be remaining completely confidential.

❒ I understand the purpose of the survey and I am voluntarily participating in this survey.

Understanding TAM users' knowledge, attitudes and perception

in South Africa.

In this survey, the term "cancer" means diseases caused by an uncontrolled division of abnormal cells in a part of the body.

"Wildlife farming" refers to the raising of non-domesticated animals in an agricultural setting to produce whole living animals and commodities such as food and traditional medicine.

a. What is your self-identified gender?

❒ Male   ❒ Female

b. What is your age? _____ years

c. What is the highest level of education you have completed?

❒ None
❒ Primary school
❒ Secondary school/High school
❒ College/University
❒ Masters/PhD

d. What is your nationality?

_____

e. What is your ethnicity?

_____

1. Why do you **choose TAM over other medical treatments**, for example, western or traditional African medicines? (Please rank the following statement, 6 is the most important and 1 is the least important)

❐ Traditional/cultural value

❐ More effective than other treatments

❐ Cheaper than other treatments

❐ Long lasting effect compare to other treatments

❐ No side effects

❐ Personalise (mixture of ingredients according to personal preference and stage of health)

2. For each of the following statements, indicate **whether the statement is applied to you**. *Circle one number for each statement.*

		Disagree	Neither	Agree
a	Most people I know prescribe Western Medicine	1	2	3
b	Most people I know prescribe traditional medicine	1	2	3
c	The people closest to me have used wild animal parts as medicine in the past	1	2	3
	d. The people closest to me believe I should use wild animal parts as medicine	1	2	3

3. For *each* of the following statements, indicate whether you believe it is "True", "False", or "Don't Know." *(Please circle your response for each statement.)*

		True	False	Don't know
a	Wild animal parts are essential in Traditional Medicines	T	F	DK

b	In Traditional Asian Medicine, lion bone is a valid alternative to tiger	T	F	DK
c	In Traditional Asian Medicine, rhino horn can cure cancer	T	F	DK
d	In Traditional Asian Medicine, most bears bile and gallbladders come from farmed bears	T	F	DK
e	In Traditional Asian Medicine, Asian pangolin scales have similar effects in treating illness	T	F	DK

4. According to your knowledge of TAM, what is rhino horn **most effective** in treating? *(Please write down the first symptoms/illness you think of)*

………

5. If you **must** choose one of the following animal parts as TAM, which of the following do you **prefer** to use? *(Please tick one box in each pair)*

❒ Bear bile   OR   ❒ Bear gallbladder

❒ Bone from wild tiger   OR   ❒ Bone from farmed tiger

❒ Asian pangolin scale   OR   ❒ African pangolin scale

❒ Tiger bone   OR   ❒ Lion bone

❒ Bone from farmed tiger   OR   ❒ Bone from wild lion

❒ Asian rhino horn   OR   ❒ African rhino horn

❒ Wild rhino horn   OR   ❒ Farmed rhino horn

6. What is your **greatest concern** when using wild animal parts as TAM? *(Please tick on 1 box only)*

❒ Poison

❒ Extinction of endangered wild animals

❒ Fake products

❏ Transmission disease from wild animals to human

❏ Violating the law (if consume protected species)

Other:…………………………………………………………………………………

7. Have you ever use wild animal parts as **TAM**?

❏ Yes   ❏ No

If No, please continue to the next question.

If Yes: How often do you consumed wild animal parts as medicine over the last 12 months?

❏ 1 – 5 times   ❏ Over 10 times

❏ 6 – 10 times   ❏ Cannot remember/Do not know.

8. Below are statements representing different ways that people might think about the use of wildlife products in Traditional Asian Medicines (TAM). We're interested in knowing *your* **views about <u>TAM.</u>**
(Circle one response)

		True	False	Don't know
a	I think rhino horn should be available for medical treatment	T	F	DK
b	I think tiger bone should be available for medical treatment	T	F	DK
c	I think lion bone should be available for medical treatment	T	F	DK
d	I think pangolin scale should be available for medical treatment	T	F	DK
e	I think bear gall and bile should be available for medical treatment	T	F	DK

Thank you for participating in our survey

Chapter 5

Application of Specialised Questioning Techniques in South Africa

to detect consumption of endangered animal parts in

Traditional Asian Medicine

5.1. Abstract

Due to considerable international pressure around the illegal trade of rhino horn and tiger bone, direct questioning of wild animal parts consumption may not be eliciting a truthful response due to the desire to meet socially acceptable norms. In recent years, the severity of penalties and fines for wildlife crimes has increased sharply in South Africa, largely through amendments to relevant legislation. This study aims to explore the level of wild animal parts being consumed in South Africa for Traditional Asian Medicine (TAM) purposes by applying two sensitive questioning techniques (SQT), namely Randomised Response Technique (RRT) and False Consensus Bias (FCB). We also compare the applicability of these two techniques in South Africa, across multiple ethnic groups, in researching illegal consumption of wild animal parts in TAM. Our results show that there is a considerable demand for animal parts used in TAM in South Africa, not only from the Asian and Chinese African TAM users, but also by the local African peoples. This potentially poses as a serious threat to local African wildlife, as well as species worldwide. In addition, the results overall indicate that respondents were under-reporting their consumption of wild animal parts in TAM when directly asked, therefore future studies should consider apply SQTs. Continued exploration of the most appropriate methods to be used, particularly given the sample's diverse demographic and cultural context.

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5.2. Introduction

The use of endangered animal parts for traditional medicine has been recognised as a major threat to the world's biodiversity (Alves et al., 2013; Duffy et al., 2015; Ogada et al., 2016). However, this practice has a long history, becoming ingrained in many cultures and as a result human behaviour (Lee et al., 2014; Van Vliet et al., 2017; White et al., 2004). Previous research has shown the motivation behind consuming wild animal parts as medicine is complex and may not be only related to pharmaceutical effects, but also rituals and beliefs (Chapter 4; White et al., 2004). Practitioners and consumers of Traditional Medicine often believe that through the consumption of a wild animal's body parts they will absorb strength of the wild animal and therefore enhance their personal health (Ellis, 2005; Williams and Whiting, 2015). For example, centipedes are used to treat joint problems due to their numerous legs and feet in Traditional Asian Medicine (TAM) (Pemberton, 1999) and baboon bones (*Papi*o spp) are used in Traditional African Medicine based on their agility character (Pujol, 1990).

The Chinese government has placed a ban on the use of tiger bone and rhino horn in TAM since 1993 (Nowell et al., 2011), and restricted the use of pangolin scales to approximately 700 licensed hospitals and 70 medicines manufactured by authorised pharmaceutical companies (SFA, 2008; Hu, 2016; Xu et al., 2016). The use of wild bear bile has been banned, however farmed Asiatic black bear (*Ursus thibetanus*) bile and bile products are still allowed to be use as medicine in China (Crudge et al., 2019). As a result of the decline in tiger population and continuing ban by the Chinese government, TAM practitioners and users have turned to other big cats for their bones, such as the African lion (Williams et al., 2015).

Endangered, while popularly used in TAM, rhino, tiger, bear and pangolin are listed under Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), which means that international commercial trade, including in their parts and derivatives, is banned. However, products such as bear gall and bile have been found in TAM shops and clinics outside

of Asia, such as Australia (Coghlan et al., 2012) and South Africa (Chapter 2). Research has also shown

that TAM practice, including the use of wild animal parts as medicine is widely accepted among the local

African TAM users (Chapter 3 and 4). To tackle the illegal wildlife trade, interventions are needed for

both supply and demand side (Veríssimo and Wan, 2019; Wallen and Daut, 2018; Willemsen and

Watson, 2018). Therefore, research is need into the behaviour of consumers that utilise wild animal part

in TAM in order to inform and enhance behaviour change initiatives.

Over recent years, the severity of penalties and fines for wildlife crimes has increased sharply in

South Africa, largely through amendments to relevant legislation. Violators potentially face a maximum

of a R10 million (c. USD 677,000) fine, and jail sentences of 5 or 10 years in the case of repeat offenders

(DLA Piper, 2014). Due to considerable international pressure around the consumption of rhino horn

and tiger bone in TAM, direct questioning of these consumers may not be eliciting a truthful response

due to the desire to meet socially acceptable norms (King and Bruner, 2000; St John et al., 2010). In

recent years, specialised questioning techniques (SQTs), such as Randomised Response Technique (RRT)

and False Consensus Bias (FCB) have been applied to investigate unwanted activities in wildlife

conservation in order to elicit truthful answers from respondents (Conteh et al., 2015; Davis et al., 2019;

St John et al., 2015). The RRT requires a randomising device (e.g. a dice) to integrate an element

probability in the question-answer process of the respondents (St John et al., 2010). This is to ensure

that the answer given by respondents will never be known by the interviewer to increase respondent's

privacy, therefore increasing the chance of receiving honest answers (Lensvelt-Mulders et al., 2005). FCB

requires individuals to estimate the prevalence of specific behaviours in their social groups rather than

themselves. This method works under the assumption that those who engage in certain behaviours will

give a greater estimation of the population as being involved in that behaviour (St John et al., 2015).

St John et al. (2015) used RRT and FCB to investigate the prevalence of illegal killings of

carnivores in Taiwan. While in South Africa, RRT has been used to determine the prevalence of carnivore

killings among farmers (St John et al., 2012) and illegal fishing practices (Bova et al., 2018). Johnson and van de Vijver (2002) argued that social desirability may vary between different cultural groups, therefore these techniques might yield different level of success and failure in different contexts (St John et al., 2010).

This study aims to explore the level of endangered animal parts being consumed in South Africa for TAM purposes. In addition, we also compare the applicability of two SQTs in South Africa, to multiple ethnic groups, in researching illegal consumption of wild animal parts. The results will provide a more accurate estimate of the prevalence of wildlife parts being consumed for TAM purposes in South Africa, as well as a knowledge of the use of SQTs in determining the prevalence of illegal wildlife consumption. This information is required for successful conservation management, in particular future law enforcement and behaviour change initiatives.

5.3. Methodology

The study received ethical approval from the Research and Ethics Committee of the School of Anthropology and Conservation, University of Kent.

5.3.1. Study site

South Africa is a biodiverse country with wildlife from both captive and wild sources entering the international trade chain. It has good air and maritime connections directly to Asia where demand is high. Studies have shown wild animal parts use in TAM found in Johannesburg, Pretoria, Durban and Cape Town, including products made from rhino horn, pangolin scales, bear bile/gall bladder, tiger and lion bone (Chapter 2). These sites were therefore chosen to estimate the consumption behaviour of TAM users in South Africa. TAM, *muthi* shops and clinics were identified through a systematic survey in these cities and through literature reviews of previous research on the use of wildlife products in Traditional African Medicine.

5.3.2. Survey instrument

Interviews were carried out in each city, with closed-end questions. Questions were designed and reviewed by social scientist experts. The questions were translated into Mandarin and Cantonese, then back translated into English to ensure the translated was correct. Local assistants were employed to assist the researcher in each location, including a 1-day training workshop on how to deliver the survey. The researcher was always accompanied by a Mandarin and/or Cantonese speaker during the survey.

Permission was provided by TAM shop and clinic owners to approach customers outside their locations. Potential interviewees were informed that taking part in this survey was voluntary and they could stop the survey at any time. The survey was confidential, and their identity remained anonymous. Participants' consent was recorded by ticking a box on the questionnaire datasheet. Respondents' demographic information, such as age, gender, and education level were recorded before moving on to the SQTs section.

We provided respondents with a dice as the randomising tool. The dice had one green side, one red side and four blank sides. Respondents were instructed to shake the dice in a plastic cup to hide the results from the interviewer. Respondents answered the question read by the interviewer based on the result of the dice roll, regardless of the truthful answer. If the dice came up red, respondents automatically said "no" to the question asked, regardless of whether it is true to them or not. If the dice came up green, they would always say "yes" to the question. Finally, if the dice were blank, they would answer the question truthfully. A trial question was conducted with interviewees on a non-sensitive topic to ensure they understood the method.

In the FCB section, the interviewers asked respondents to estimate how many individuals among their family members and friends have used specific wild animal parts as TAM. Eleven categories were

given to the participants to choose from, ranging from 0%, 1-10%, 11-20%, 21-30%, 31-40%, 41-50%, 51-60%, 61-70%, 71-80%, 81-90% and 91-100% (Table 5.1) over the past 2 years.

At the end of the survey, respondents were asked five direct questions (DQ) regarding the use of products made from five species, pangolin, lion, bear, tiger and rhino.

Table 5.1: Question used in the survey, in order of appearance.

False Consensus Bias (FCB)
Think of your friends and family members. How many of them do you believe over the last 2 years
1. have used pangolin parts in TAM; a.1-10% b.11-20% c.21-30% d.31-40% d.41 – 50% e.51-60% f.61-70% g.71-80% h.81-90% i. 91-100%
2. have used lion parts in TAM; a.1-10% b.11-20% c.21-30% d.31-40% d.41 – 50% e.51-60% f.61-70% g.71-80% h.81-90% i. 91-100%
3. have used bear parts in TAM; a.1-10% b.11-20% c.21-30% d.31-40% d.41 – 50% e.51-60% f.61-70% g.71-80% h.81-90% i. 91-100%
4. have used tiger parts in TAM? a.1-10% b.11-20% c.21-30% d.31-40% d.41 – 50% e.51-60% f.61-70% g.71-80% h.81-90% i. 91-100%
5. have used rhino parts in TAM? a.1-10% b.11-20% c.21-30% d.31-40% d.41 – 50% e.51-60% f.61-70% g.71-80% h.81-90% i. 91-100%
Please circle the category that is correct for your answer. *If your answer is 0, please put an X next to the question.*
Randomised Response Technique (RRT)
1. Have you ever use pangolin parts in TAM over the last 2 years?
2. Have you ever use lion parts in TAM over the last 2 years;
3. Have you ever use bear parts in TAM over the last 2 years;
4. Have you ever use tiger parts in TAM over the last 2 years?
5. Have you ever use rhino parts in TAM over the last 2 years?
Direct Question (DQ) (Yes/No answer)

1. Have you ever use pangolin parts in TAM over the last 2 years?

2. Have you ever use lion parts in TAM over the last 2 years;

3. Have you ever use bear parts in TAM over the last 2 years;

4. Have you ever use tiger parts in TAM over the last 2 years?

5. Have you ever use rhino parts in TAM over the last 2 years?

5.3.3. Data analysis

To calculate prevalence estimation for RRT, the following formulae were used:

$$\pi = \frac{(\lambda - \theta)}{s}.$$

Where π is the estimated proportion of the respondents that have consumed the specified

wildlife parts as TAM, λ is the proportion of all answers that are "yes", θ is the probability of the answer

being a prescribed 'yes', and s is the probability of being asked to answer the question truthfully. This

equation follows Hox and Lensvelt-Mulders (2004).

Data from FCB was calculated by counting the number of times each category was chosen by

respondents (Davies et al., 2019). The category that was chosen the most by respondents were

considered as the estimate of prevalence. Results from FCB were matched with the number of

respondents who self-admitted in the direct questions to having consumed wildlife parts in TAM. This

allows us to be certain of whether respondent's belief in the prevalence of the behaviour is higher

among those who have used wildlife parts in comparison to those who have not.

Data from these methods were then compared using a Chi-square test to determine differences

in respondents' use of wildlife parts in traditional medicines. In addition, respondents were grouped into

non-users and users to compare FCB responses. The 95% confidence intervals were calculated for each

estimate following St John et al. (2012). Data was analysed using R 3.4.1 software program for

statistically differences (R Core Team, 2017), excepted for the result of RRT that were calculated using the above formula implemented in Microsoft Excel.

5.4. Results

5.4.1. Respondents profile

A total of 1,442 respondents participated in this survey. Of these, 40.5% (n= 584) were from Johannesburg, 30.4% from Durban (n=438), 15.5% from Pretoria (n=217), and 14.1% from Cape Town (n=203). There were more male than female respondents (males 59.5%, n=858 versus females 40.5%, n=584). The mean age of respondents was 38.5, with the youngest male and female TAM users being 20 years old, and oldest male and female respondents were 93 and 89 respectively. A bachelor's degree was the most common highest education level reached by the respondents (71.1%, n=1,025). Most respondents declared themselves to be freelancer or self-employed (35.1%, n=519).

Of the participants, 48.2% identified themselves as local African people (n=695), followed by 42.0% as Chinese African (n=605) and 9.6% as Asian (n=142). The sample in this survey does not represent South Africa's demographics as it focuses only on TAM users in South Africa.

5.4.2. Estimation from RRT

Prevalence estimates for the consumption of products from lion, pangolin, tiger, bear and rhino are presented in Figure 5.1. As shown, RRT prevalence estimate resulted in significantly higher than DQ and consistent with the results found for all animal parts. Pangolin had the highest RRT estimate of prevalence (34.2%) while lion had the highest estimate of prevalence based on DQ (6.6%). Prevalence estimates were significantly different between species (pangolin (CI: 0.31-0.36), lion (CI: 0.17-0.21), bear (CI: 0.30-0.35), tiger (CI: 0.18-0.22) and rhino (CI: 0.13-0.16) with the exception of pangolin vs bear, and lion vs tiger.

Prevalence estimates for all five products based on RRT were consistently higher than those yield from DQ at each location (Figure 5.2). Johannesburg had the highest estimates for lion, tiger, bear and rhino products, whereas Durban had the highest estimate for pangolin parts. Cape Town consistently had the lowest estimates for all species. Prevalence estimates for pangolin consumption in Johannesburg (CI: 0.02-0.31), were significantly different to Durban (CI: 0.39-0.48) but not Pretoria (CI: 0.30-0.43), and Cape Town (CI: 0.20-0.33). Significant differences were also found between Johannesburg (CI: 0.31-0.44) and Durban (CI: 0.19-0.28) and Pretoria (CI: 0.09-0.14), however Pretoria did not differ significantly from Cape Town (CI: 0.06-0.15) for lion parts. No significant difference was found between cities for bear parts: Johannesburg (CI: 0.39-0.42), Durban (CI: 0.25-0.32), Pretoria (CI: 0.27-0.40) and Cape Town (CI: 0.22-0.34).
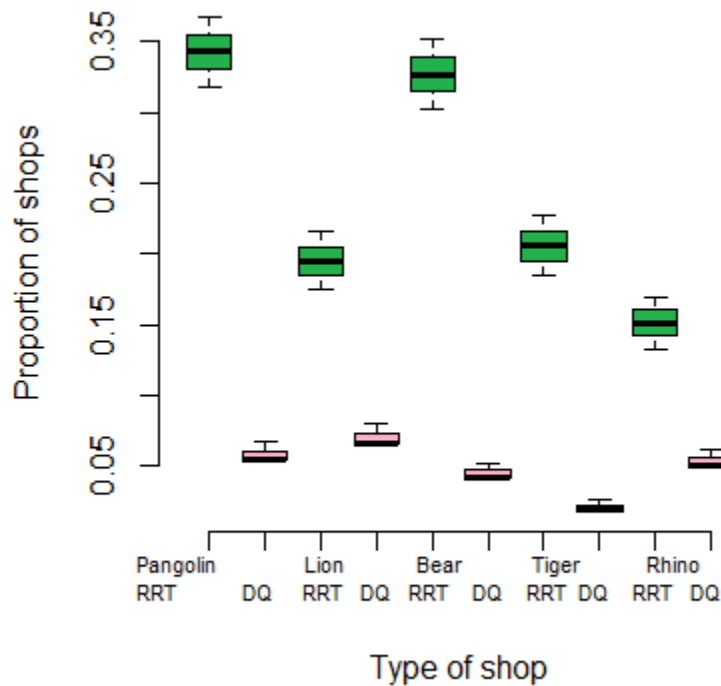
Figure 5.1: Results from Randomised Response Technique (green) and Direct Question (pink) showing estimation of TAM users consuming products from pangolin, lion, bear, tiger and rhino in South Africa.

Regarding tiger parts, no significant difference was found between Johannesburg (CI: 0.21-0.28), Durban (CI: 0.11-0.21), Pretoria (CI: 0.18-0.26), however differences were found between Johannesburg and Pretoria when compared to Cape Town (CI: 0.05-0.13). A significant different was not detected
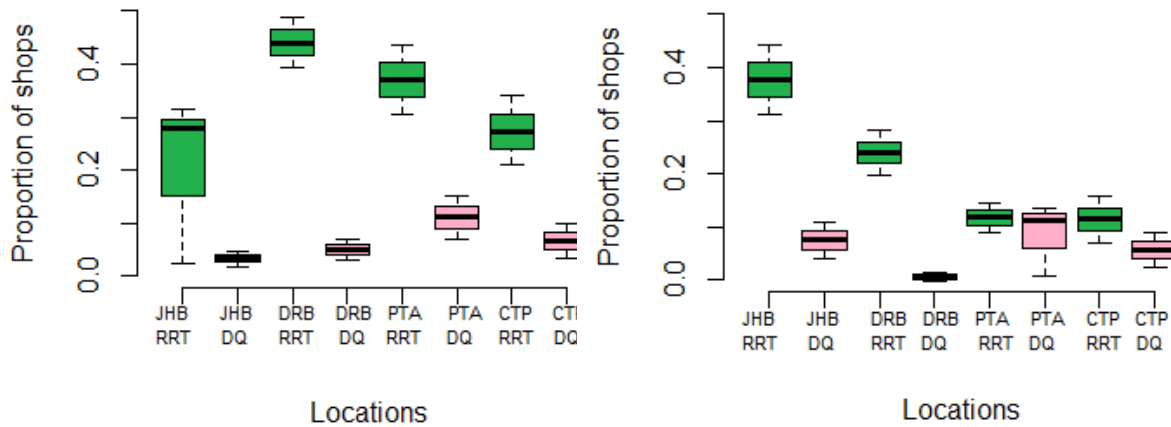
b) Pangolin

b) Lion
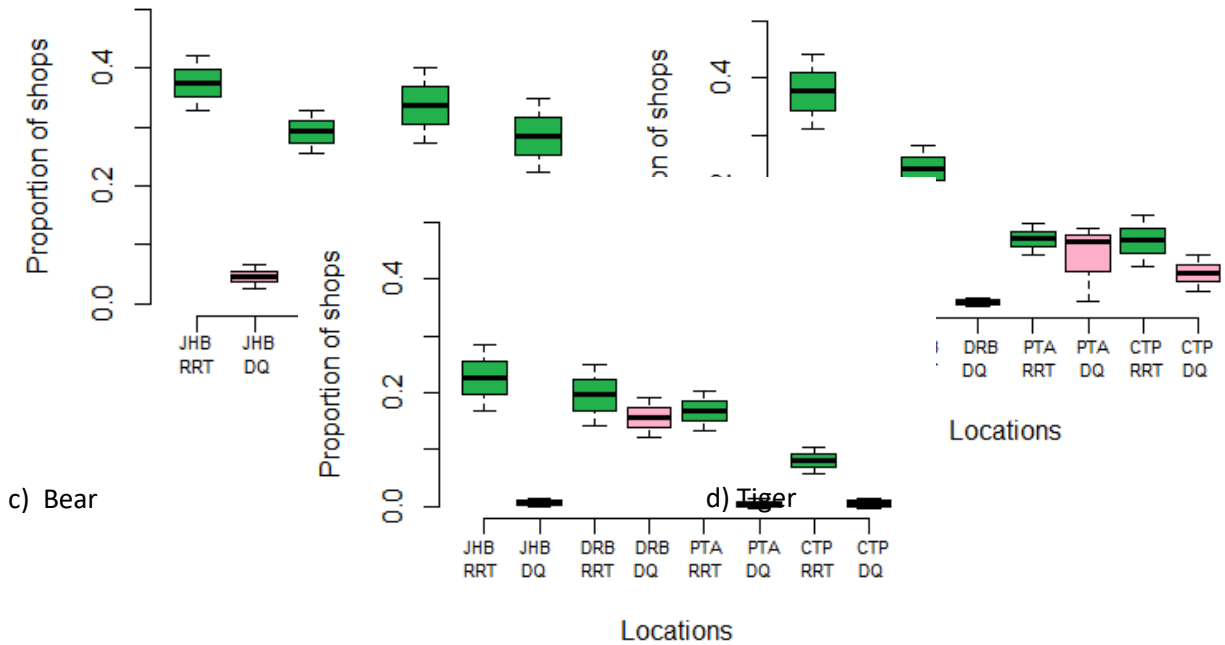
c) Bear

d) Tiger

e) Rhino

Figure 5.2: Prevalence estimates of a) pangolin, b) lion, c) bear, d) tiger and e) rhino part use obtained through Randomised Response Technique (green) and Direct Question (pink) for all four field sites: Johannesburg, Durban, Pretoria and Cape Town.

between Durban and Cape Town in term of tiger parts consumption. Similar patterns were found for rhino horn consumption, with Johannesburg (CI: 0.16-0.28), Durban (CI: 0.14-0.25), Pretoria (CI: 0.13-0.20) showing no significant difference, however a significant difference was seen when compared with Cape Town (CI: 0.05-0.10). It is important to point out that the prevalence estimates of tiger and lion part use are extremely similar. This could be because the respondents misidentified products, as lion parts are often used as substitutes for tiger parts in TAM.

5.4.3. Estimation from False Consensus Bias

Figure 5.3 shows the differences in estimation between different groups estimated by FCB method. FCB gave a similar estimate of prevalence to RRT in the use of lion products (11-20% versus 19.3%). However, FCB gave lower estimates than RRT in the cases of pangolin (11-20% versus 34.0%), tiger (1-10 % versus 20.4%) bear (1-10% versus 32.3%) and rhino (1-10% versus 14.9%).

By grouping respondents from direct questions to users and non-users of each products, we found significant differences between estimates using FCB for pangolin (χ^2=40.716, df=1, p<0.001) and bear (χ^2=14.014, df=1, p=0.004). However, no significant differences were found for tiger (χ^2=4.601, df=1, p=0.331), lion (χ^2=11.771, df=1, p=0.038) and rhino (χ^2=7.169, df=1, p=0.127). Bonferroni adjusted alpha levels of 0.01 per test (0.05/5).
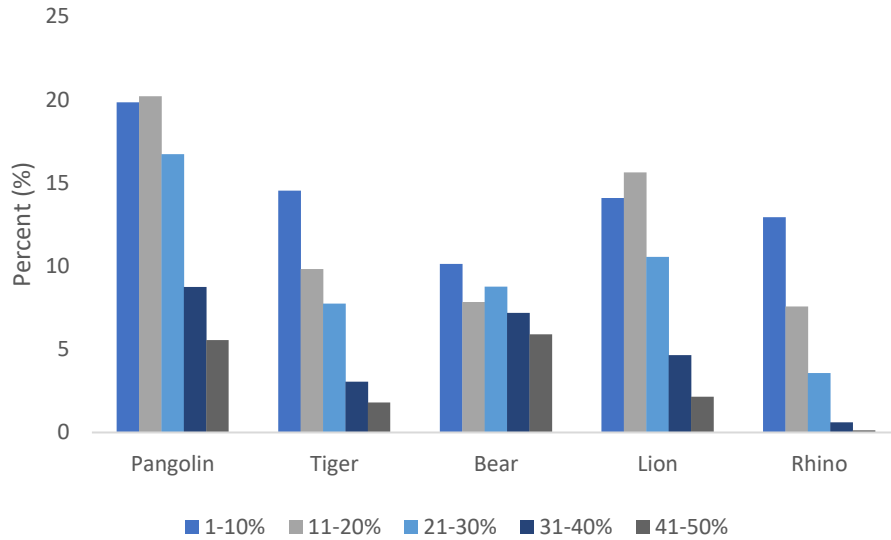
Figure 5.3: Use of products made from pangolin, tiger, bear, lion and rhino was estimated by all respondents using False Consensus Bias.

5.5. Discussion

This research provides estimates of wildlife part consumption in TAM using multiple questioning techniques. Four out of five focus species (with exception of lion) in this research are listed in Appendix I CITES and are protected from international commercial trade. However, non-native species, such as bear and tiger have been found for sale over the counter (Chapter 2) and widely used in South Africa (Chapter 4).

The significant differences were found between RRT and DQ across all 5 focused species, suggesting that the use of these animals in TAM is considered a sensitive topic by respondents. Pangolin and bear parts were the most widely used TAM products of those considered in this study in South Africa, whereas rhino part was the least consumed. Prevalence estimates obtained from RRT show that use of Asian originated products was high among TAM users in South Africa (32.3% for bears and 20.5% for tigers), compared with the use of pangolin (34.0%), lion (19.3%) and rhino (14.9%). This may be due

to the differences in the number of TAM treatments each species is used for, and the availability of the product.

Across South Africa, rhino horn was the least consumed based on RRT and DQ and was only estimated to be used by 1-10% of consumers using FCB. There was no statistical difference between rhino horn users and non-users' based on the FCB. This could suggest that the number of respondents consuming rhino horn is so small that it is not detectable using FCB; this is supported by the low estimates using RRT and DQ. However, it could also be that they intentionally responded dishonestly due to social desirability bias. Desirability bias is an important consideration as many Chinese Africans in South Africa feel that they are the target of racism due to attention given to the poaching of rhino and recently the use of donkey skin in TAM. In 2019, the Chinese Association in Johannesburg took 11 people to court for hate speech towards Chinese Africans, this followed the airing of a documentary on the slaughter of donkeys for the use of TAM in China (Erasmus, 2019). The stigma of admitting to using rhino horn might motivate respondents to respond dishonestly to FCB or not follow the RRT instructions when required to say "Yes" (either forced yes or truthful yes) when asked about using rhino parts.

Confidence intervals of RRT and DQ overlapped each other for the estimations of rhino horn consumption in Durban, but were different everywhere else. This may indicate that, unlike other cities, the use of rhino horn was not considered as sensitive by respondents in Durban. Cape Town is the city with the lowest estimation for rhino horn consumption, both RRT and DQ (0.8 and 0.6 respectively), and also for other wild animal products. This may be because Cape Town is a tourist destination (tourism industry accounted for up to 7.5% of the city's GDP) and more developed than other cities in South Africa (Smith, 2017). Nevertheless, the estimated proportion showed in this study could be considered high, given the severe sentences that offenders potential face if caught. Overall, lion parts were estimated as the second lowest products used by TAM users in South Africa and was mainly mentioned by respondents from the local African community. Chapter 4 showed that Asian and Chinese African of

TAM users prefer tiger over lion products for TAM use. This possibly suggests that the Asian and Chinese African users do not use lion parts in TAM, they could already have access to tiger products and are therefore not interested in using lion parts as an alternative. Recently, South Africa has emerged as a potential hotspot for tiger farming and trade of its products (EIA, 2017). An estimated 280 tigers are kept in at least 44 facilities across South Africa, with some of the largest farms being near the Gauteng area (Johannesburg and Pretoria) (Williams et al., 2015). In 2018, nine men were arrested for allegedly being in possession of lion bones and tiger parts (Gous, 2018). This is not the first time South Africa has been implicated in illegal tiger trade, as 7.7 kg of tiger bone were seized in 2015 (EIA, 2018). High estimates in the use of tiger and bear products were found in Johannesburg and Pretoria could therefore be due to the popularity and availability of these products (Chapter 2). In addition, as Johannesburg and Pretoria are geographically closer to each other than Durban and Cape Town, it is not unreasonable for one to expect to see similar consumption patterns in these two cities.

Based on these results, there is a potentially worryingly high percentage of local Africans consuming wildlife parts for TAM purposes, including non-native species such as tiger and bear. Bear parts seem to be extremely popular among surveyed TAM users across all cities. This might indicate greater availability of bear bile and gallbladders for sale as medicine in South Africa, or at least products that are falsely advertised as bear bile and gallbladders. Chapter 4 pointed out that Asian TAM users are concerned about the trade in fake product, specifically citing bear bile and gallbladder as an example.

In response to the FCB questions, a majority of respondents estimate 1-10% of their peers have consumed products made from the five focused species. This is similar to results obtained from DQ, however, estimates for pangolin and bear parts were lower than RRT. We found that those who self-admitted to be users are more likely to estimate a higher percentage of wildlife consumers in their social circle than non-users for pangolin, lion and bear products; but not rhino or tiger. This pattern fits with research conducted in Taiwan on the killing of carnivores (St John et al., 2015) and Cambodia on the use

of bear parts (Davis et al., 2019), they also found those who self-admitted to violating laws were significantly more likely to estimate that a higher percentage of people around them displayed the same behaviour. Similar to FCB estimates of rhino horn consumption, no difference was detected between users and non-users for prevalence estimations of tiger part using FCB. This could be due to high media attention on cases of Asian migrants being arrested while possessing tiger parts (Bloch, 2019; Gous, 2018). As such, respondents could potentially lie in the self-admitted section while still giving high estimates for consumption of tiger parts in their social circle.

The RRT appears to have been successfully applied in this study as it gave consistently higher prevalence estimates compared to DQ. The high prevalence estimations has been taken as evidence of more honest answer by respondents in other studies (Lensvelt-Mulders et al., 2005; Solomon et al., 2007; St John et al., 2010; St John et al., 2015). Going forward, a longitudinal study looking at the consumption of wildlife parts South Africa, applying the same methods and questions, would help identify potential trends over times. FCB methods appeared to show a mix of results, requiring further study to fully determine whether or not it can be applied in researching illegal consumption behaviour of wild animal parts in South African.

5.6. Conclusion

Behaviours, such as the illegal trading and consumption of wildlife parts, are threatening global biodiversity (Burn et al., 2011). It is important to have consumer data to triangulate with enforcement, for example trends in seizure data may not reflect the number of animals poached. It is necessary to monitor the use of wildlife parts over time as law enforcement and behaviour change interventions that could potentially increase the sensitivity of the topic. It is therefore important to explore the use of SQTs to determine the accuracy of responses to sensitive questions.

Although consuming expensive or prohibited wildlife parts might be desirable to some as they can boast about it and be admired by their peers (St John et al., 2010), directly questioning about such behaviour has proven to be difficult and often received a low rate of response and dishonest answers (Nuno and St John, 2015). By combining RRT, FCB and DQ in this research, we found RRT yield significantly higher estimates of wild animal parts consumption than the conventional direct questioning. Further, our results showed that there is a considerable demand for animal parts used in TAM in South Africa, not only from the Asian and Chinese African TAM users, but also by the local African peoples. This potentially poses as a serious threat to local African wildlife, as well as species worldwide.

Finally, there is a need to include protection for endangered, non-native species, such as bears and tigers, within the South African legislation. While enforcement is an essential part of combating illegal wildlife trade and consumption, understanding the prevalence of consumption is vital to inform decision makers and relevant stakeholders. Future research into the behaviour and attitude of wildlife consumers should consider apply SQTs and continue to explore the most appropriate method to be used, particularly given the sample's diverse demographic and cultural context.

5.7. Acknowledgement

5.8. References

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Chapter 6

General Discussion

The trade in wildlife is vast, diverse and multifaceted. Whilst the regulated legal trade can bring benefits to the economy and society, the illegal trade threatens biodiversity and, in turn, impacts human wellbeing (Broad et al., 2003; Karesh et al., 2012; Warchol, 2004). The use of wildlife parts, including plants and animals, has been identified as the main driver for the illegal trade (Liu et al., 2016). Given the growth of Traditional Asian Medicine (TAM) across the globe, due in part to the development of the Chinese Belt and Road Initiative (BRI), there is an obvious reason for concern about the increasing demand for endangered wildlife parts used in TAM. Various management interventions and strategies are implemented by decision makers and relevant stakeholders in order to combat illegal wildlife trade, including anti-poaching patrols on the ground (Masse, 2019), or regulated legalised trade in certain species, in accordance with the Convention on International Trade in Endangered Species (CITES).

In order to inform and enhance policy and management decisions, a better understanding on the scale of the illegal markets, the use of wild animal parts, as well as the profile of consumers is required. This thesis is the first in-depth study into the use of wild animal parts in TAM within South Africa. The aim is to expand our knowledge of the impacts of TAM outside Asia, drawing on interdisciplinary and novel research approaches.

6.1. Thesis synthesis

Endangered, but commonly used in TAM, products from Asiatic black bears (*Ursus thibetanus*), tiger (*Panthera tigris*), pangolin (*Manis* spp*.*), rhino (*Rhinoceros* spp*.*) and recently lion (*P. leo*) were the focus taxa of this thesis. Starting from the supply side of the trade, Chapter 2 investigated the local African wildlife markets and observed the type of wild animal parts used for TAM to understand the

trade dynamics and identify knowledge gaps for future research. Whilst TAM consumers have been studied throughout in Asia and Southeast Asia (Crudge et al., 2018; Drury et al., 2011; Nowell et al., 2011), this is the first study of its type in Africa. The analyses revealed that there are a considerable number of wild animal parts being sold for TAM purposes in South Africa, possibly including parts from Asian species, such as bear bile and bear gallbladder, as well as processed products containing wildlife parts that were manufactured within Asia and smuggled into South Africa. Using genetic analysis of TAM products from the same manufacturer as those observed in South Africa, we confirmed the presence of Asiatic black bear DNA in samples outside Asia, highlighting violations of trade regulations and demonstrating the global nature of the TAM market (Appendix C). Chapter 2 highlighted significant information gaps regarding the domestic demand for animal-based TAMs in South Africa, and identified consumer profiles, motivations and preferences towards different species or origins of the wild animals used. We also demonstrated the need for more research into the adoption of TAM practices among the local African community.

To address the gaps identified by the market survey, chapters 3 and 4 explored the knowledge, attitudes and practices of TAM practitioners and users in South Africa. The four main cities in South Africa, namely Johannesburg, Durban, Pretoria and Cape Town, were chosen as study sites because they are home to a high density of Chinese African and Asian residents (Park and Chen, 2009). Clusters of TAM shops, clinics and wildlife trade markets were found in these locations (Chapter 2). Chapter 3 explored the use of wild animal parts in TAM through structured interviews with TAM practitioners and doctors. Previous studies have been conducted throughout Asia on TAM practitioners and in Africa on Traditional African Medicine practitioners (Boakye et al., 2015; Dunn, 2010; Whiting et al., 2013), but none has been conducted on the use of TAM in Africa. This research revealed that practitioners and doctors in South Africa are prescribing endangered parts for TAM purposes.

Chapter 4 expands our knowledge into the consumption of TAM in South Africa by exploring TAM users' perceptions of consuming wild animal parts as medicine. The findings suggest that there were three main groups of TAM consumers: the Asian new migrant, the Chinese African, and the local African peoples. Among these groups, local Africans and Asians seem to be more open to the use of the five focus taxa, whereas the Chinese Africans are more reserved. Local African TAM users were identified as young, educated people; with a bachelor's degree being the most frequent highest education level recorded amongst self-reported wildlife users. This is in line with findings from Chapter 2 and 3, that the practice of TAM, including the use of wild animal parts, has been accepted by the local community, posing as a threat to local and global biodiversity.

Chapter 5 set out to estimate the demand for wild animal parts for TAM purposes, by employing Specialised Questioning Techniques (SQTs), specifically Randomised Response Technique (RRT) and False Consensus Bias (FCB), to elicit truthful answers from respondents and obtain more accurate estimates of the prevalence of wildlife use (St John et al., 2012). These techniques have been widely used on other topics and in other countries (St John et al., 2010; St John et al., 2015) but have not previously been applied to the study of traditional medicine consumption of wild animal parts in Africa. This chapter not only provides a knowledge of wildlife consumption level, which is vital for developing conservation interventions, but also evaluates the application of two SQTs. Prevalence estimates of wildlife parts used in TAM were higher than expected, including the use of parts from species not native to South Africa, such as tiger, which fits with the findings of Chapter 2 and 3. This study has shown that RRT provided a higher prevalence estimate than Direct Questioning, and suggests that SQTs should be examined, tested and implemented in South Africa in order to investigate sensitive behaviours, such as wildlife consumption.

6.2. Application to Conservation Science and Wildlife Trade Policy and Practice

Issues addressed in this thesis are receiving much attention from the public, as well as decision

makers and relevant stakeholders worldwide. This thesis highlighted information that is directly relevant

to CITES, the Convention on Biological Diversity (CBD), the UN Sustainable Development Goals (SDGs),

and the South African National Environmental Management Biodiversity Act. Both CITES and CBD

promote the sustainable utilisation of biological diversity and support trade in species where that trade

does not threaten their survival (CBD, 2014; CITES, 2019). The SDGs listed by the United Nations (2016)

set targets for countries to conserve and sustainably use biodiversity, and to combat poaching and

trafficking through increasing local capacity to pursue sustainable livelihoods (Goal 15).

At a national scale, the South African National Environmental Management Biodiversity Act

regulates the trade of wild species to ensure their survival and provide protection to those that are

threatened or in need of national protection (DLA Piper, 2014). This thesis addresses a number of

significant gaps in our understanding of the threat posed by introducing TAM to South Africa as well as

the weaknesses in domestic regulations that are creating opportunities for this illegal trade. Information

provided by this thesis can be used to inform conservation management, enhance the effectiveness of

interventions, provides baseline data and assesses techniques with which to monitor and evaluate

intervention effectiveness, and highlights the need of cross-sectoral collaboration, particularly with

healthcare and other sectors.

6.2.1. Human migration, BRI development and TAM

There are several reasons for people to migrate, including political and economic instability (Brunow et

al., 2015), war (Balcilar and Nugent, 2018), globalisation (Segal, 2019), and recently, environmental

disasters (Adam and Kay, 2019; Thorpe and Figge, 2018). For example, Myers (2002) forecasted that by

2050, there will be 150 million environmental refugees due to climate change. Within 12 years (2000-

2012), an estimated 2.74 billion people were killed or otherwise affected by climate related disasters in

Asia alone (Berchin et al., 2017). Asia is the continent with the highest numbers of people exposed to

the impacts of the climate crisis, including the rise in sea level, and thus is predicted to have a high rate

of migration (Busby et al., 2018; William, 2008). Low coastal areas, such as those in southern Vietnam,

Bangladesh and Cambodia, are areas of particular high risk (Figure 6.1.).
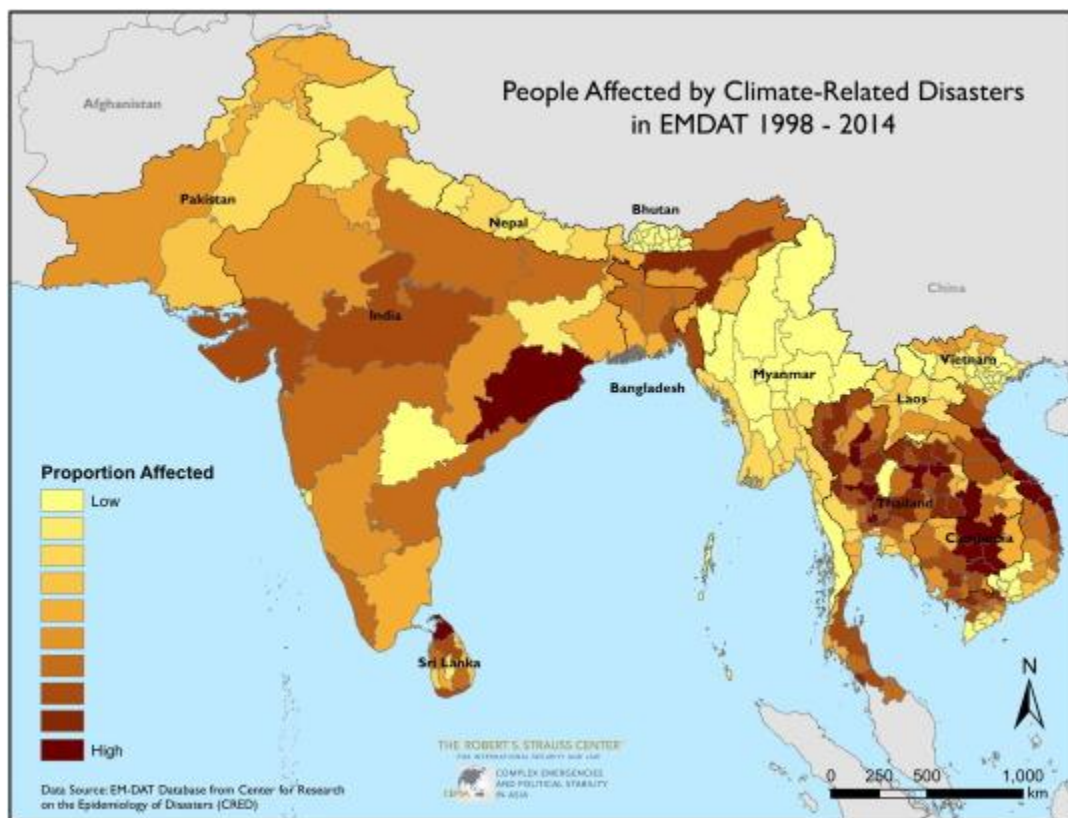
Figure 6.1: Climate-related disaster affected (proportional to population, population weighted), Busby et al., 2018.

Over the past few decades, approximately 340 million Chinese citizens have migrated from their

home town to search for a better life (Chan, 2011). The recent wave of Chinese migrants is heavily

influenced by geopolitics, through the development of China's Belt and Road Initiative (BRI). BRI is the

largest infrastructure project in human history, planning to span over 65 countries (The World Bank,

2018) and over 7,000 projects have already been contracted in 2017 (Figure 6.2) (Kirchherr et al., 2018).

Prior to the development of BRI, China invested in the energy and mining sectors in Africa, with

approximately one-third of global investment during 2005-2016 (Scissors, 2017). Kolstad and Wigg

(2011) noted that Chinese government exclusively invest African countries for their natural resources.

However, Chinese businesses tend to hire Chinese workers rather than local people (Isaksson and

Kotsadam, 2018), and Chinese workers tend to stay after completing their contract (Park, 2012). This, in

addition to Chinese migration through BRI development, together with people from Asian countries who

migrate due to climate change, foster linguistic and Asian cultural exchange, including the knowledge

and practice of traditional medicines.

This study uses South Africa as an example of the persistent use of TAM in citizens with Asian

heritage, and the perceived efficacy of wild rather than farmed wildlife. The use of wild animal parts,

such as bear, and tiger in TAM and are believed to be a part of the Asian culture (Ellis, 2005). Whereas in

Africa, wild animals such as lion, rhino and pangolin are also being consumed for Traditional African

Medicine (TAfM), as well as for religious and ritualistic purposes. As people are more easily accept and

adopt practices that are similar to their own, the local South African people have adopted the use of

Asian originated species, such as bear and tiger in TAM (Chapter 2, 3 and 4).

Figure 6.2: BRI map, including the Silk Road Economic Belt (red) and the Maritime Silk Road (blue), connecting China, European countries and Africa. Source: Top China travel.

South Africa is representative of the trends across the African continent, and possibly elsewhere, where increased investment in infrastructure has resulted in an increase in the population of people of Asian heritage, including over 1 million Chinese nationals in countries across Africa (Liao & He, 2015), making up as much as 10% of the population in some countries (Poston & Wong, 2016). In addition, China also plans to direct invest USD250 billion in the Latin America region, and is currently the largest trading partner of Argentina, Brazil, Chile and Peru. Bale (2018) noted an increased trade in jaguar products, including jaguar balm (bone cooked into a gluey paste), in Suriname where Chinese migrants have settled. It is known that South American traditional medicine also includes the use of wild animal parts (Alonso-Castro, 2014), as such there is a possibility that, similar to South Africa, local South American people might have adopted the use of TAM.

In addition, the BRI represents a step-change in the ability to transfer resources from all over the world to China through the creation of new roads leading directly to ports (Damania et al., 2005). New roads across Asia and Africa have already been implicated in the significant increase in hunting pressure, and a decrease in the population of species perceived as high value (Abernethy et al., 2013). Therefore, the cultural and historical similarity of countries across the African continent, and possibly those in Latin America, might show the same patterns to those highlighted here. This situation warrants further attention and research to ensure the impact of migration and BRI development is clearly understood and addressed by policy makers.

6.2.2. Informing wildlife trade policy and management

Risks associated with the development of BRI and the promotion of TAM, as well as opportunities for management interventions, have been identified in this study. For example, by using South Africa as a case study, this research found that deficiencies in South African legislation are creating opportunities for illegal trade and consumption of protected species. These legislative weaknesses undermine the power of CITES and are exploited not only in South Africa but also Asian countries, particularly when it comes to protection of non-native species. This is also the case with unregulated domestic trade in African elephant ivory in Cambodia (Nguyen and Frechette, 2017). This illustrates the difficulties faced in relying on law enforcement alone in combatting illegal wildlife trade and highlights the importance of well-designed demand-side approaches.

To ensure that TAM use does not have negative impacts on biodiversity, collaborative efforts between organisations and relevant stakeholders (e.g. The World Health Organisation, the Association of Traditional Chinese Medicine, scientists and government bodies) are needed in order to tackle the illegal trade and consumption of wildlife. Both supply and demand side interventions are required in order to tackle the illegal trade of wildlife products (Veríssimo and Wan, 2019; Wallen and Daut, 2018;

Willemsen and Watson, 2018). Decision makers should consider encouraging or compelling TAM doctors to inform users about the legality and effectiveness of wild animal parts used in TAM.

6.2.3. Future directions for global trade in TAM

In March 2019, Chinese president Xi Jinping announced that the BRI aims to promote green development, with 27 investment parties, including major Chinese banks involved in the BRI signing a "Green Investment Principles" statement at the Financial Connectivity Forum in China (Ewing, 2019). A month later the BRI's International Coalition was launched in Beijing during the second Belt and Road Forum for International Cooperation. The Coalition brings together environmental experts of all BRI's partners to ensure long-term sustainable development in support of the 2030 Agenda for Sustainable Development. Currently, this Coalition involves 134 partners, including 26 Environmental Ministries of the United Nation Member States (UN Environment, 2019). This shows that there is political will in making the BRI sustainable.

As highlighted previously, proliferation of wildlife trade for use as Traditional Asian Medicine has the potential to undermine BRI's sustainability ambitions. Adoption of sustainable certification for wild animal parts might minimise the negative impact of TAM on local biodiversity and, if successfully implemented, a sustainable certificate scheme for TAM products would fit with both CITES and CBD aims, as well as Goal 15 of the SDGs to pursue sustainable development and support the legal trade (CBD, 2014; CITES, 2019). The UK government's standard for sustainable forest management, in which retailers must meet the necessary standards for providing legal and sustainable wood products, is a successful example of such a scheme (UK Government, 2019), although it is not without limitations.

Certificates of sustainability and labelling initiatives have become popular, especially in developed countries, due to the increase in global awareness of the impact of human activity on biodiversity (Blackman and Rivera, 2011; Lenzen et al., 2012). Labelling schemes, such as Forest Stewardship Council

(FSC), Marine Stewardship Council (MSC) and Fairtrade, encourage and support organisations to adopt more sustainable practices. For example, FSC certify that forest products come from sustainable sources, whereas MSC supports businesses around the world for the supply of sustainable seafood. In Cambodia, IBIS Rice is a label that has been developed for rice farmers who practice sustainable rice farming methods to protect the vulnerable wetland systems of Cambodia (Ibis Rice, 2019). However, to-date, there has been no attempt to apply sustainable certificate labelling to the trade of animal parts for Traditional Medicines.

Certification schemes with a strong focus on traceability and accountability might be a desirable development within the TAM industry. However, there have been issues of discrepancies with these schemes, as illustrated in the CITES trade database, as well as by ongoing illegal trade. CITES provides a database where permitted international trade of wild animal parts, whether dead or alive are recorded, with details of species, amount, and the importing and exporting country. However, discrepancies between quantities of exported and imported shipments have been recorded. For example, the State Forestry Administration (SFA) in China allows pangolin scales from verified stockpile or other legal sources, such as those imported from Africa, to be used in licensed state hospitals and clinics (Xu et al., 2016). However, there is a significant discrepancy between the import and export data, leading to the suspicion that seized pangolin scales in China might have been brought back to the illegal trade for medical use (Xu et al., 2016). There is also limited information in the CITES database regarding the collection practice or the details of the individual or organisation importing the products and their purposes. This lack of information on the origin of wild animal parts may have negative consequences on biodiversity and sustainability of the trade. In China, China's State Forestry Administration and State Administration introduced a labelling system aimed at distinguishing TAM ingredients that come from a legal source as opposed to illegal origins (WWF, 2006). In Vietnam, a three-year project was implemented in a northern province on sustainable harvesting techniques, following the FairWild

standard principles with over 1000 local wild plant harvesters. This project was a success, as at the end

of year 3, there was 20% increase in Jiaogulan *Gynostemma pentaphyllum* harvest within the area.

Further, the project was able to secure a trade contract for a purchase price 5% above the market rate

(FairWild, 2018). However, there is a lack of information as to whether certification or labelling of

wildlife parts used in TAM will be able to promote sustainable use among TAM users. In theory, these

schemes would benefit the sustainable trade and if successfully applied to traditional medicine use, it

will no doubt benefit TAM suppliers, practitioners and users. As TAM is widely being promoted through

BRI and is recognised by the World Health Organisation for its contribution to global healthcare, there

might be a need to certify that products used in TAM come from sustainable sources. However, because

of the potential risks to threatened species more research is required in order to fill important

knowledge gaps. In particular, the capacity for certification bodies and local government agencies to

monitor and regulated trade is a crucial component of such schemes. The FSC and MSC have faced

challenges relating to monitoring and oversight in a global market. Another key consideration that

would need to be investigated further is whether or not consumers will select, and possibly pay a

premium for, certified rather than uncertified products. In the meantime, existing trade regulations

should be enforced and, where required, strengthened to ensure that wild animal part trade for

traditional medicine purpose does not negatively impact biodiversity.

6.3. Limitations and future research opportunities

The use and trade of animal-based TAM outside Asia is an emerging and understudied issue. Thus,

there are numerous opportunities for future research to explore the issues covered in this thesis. Whilst

this study provides a baseline for understanding of the supply and demand for wild animal parts in TAM,

future studies are required to understand if the practice of TAM has been accepted in different parts of

South Africa, such as rural areas, and also in other African countries, especially those participating in the

BRI.

Chapters 2 and 3 provide information on several hotspots for wild animal parts traded for TAM. Further studies could investigate the benefits that local suppliers and traders receive from this trade, and if there is a relationship between the local suppliers/traders and TAM practitioners/doctors. In addition, it would be important to explore the origin of TAM products, such as whether the majority of products are being manufactured in South Africa to supply the domestic demand, or they are being smuggled from Asia. This will be vital to inform decision makers to create necessary interventions, as well as expanding our understanding of the trade chain for wild animal parts used as traditional medicines.

Chapter 4 illustrated the profile of TAM users in South Africa. However, we were not able to provide information on their socio-economic background. Future studies should be designed to obtain this information to provide a clearer understanding of TAM users' background in South Africa, as it might influence their choices. This study found that RRT was a useful method to obtain more accurate answers from TAM users. More SQTs should be examined to explore efficient methods that can be implemented given the cultural diversity of South Africa.

6.4 Epilogue

The use of animal parts for traditional medicines, which has been identified as a main driver of the illegal wildlife trade, however this topic is still understudied (Alves et al., 2010). The lack of understanding of such behaviour makes it challenging to conservation management worldwide. A range of strategies and adaptive management approaches are required to address this complex issue. Whilst it is important to identify the problems that might have been caused by the widespread use of TAM, the value of TAM in improving human health cannot be negated. TAM is an ancient type of medical treatment, most of which does not include wild animal parts. To ensure that TAM use does not have negative impacts on biodiversity, collaborative efforts between organisations and relevant stakeholders

(such as WHO, the Association of Traditional Chinese Medicine, scientists, government bodies) are

needed in order to tackle the illegal wildlife trade and consumption. Such a collaborative approach has a

significant role to play in reducing the demand for illegal wild animal parts in TAM. The studies

presented in this thesis contribute to our understanding of some of these issues to help move towards a

better informed, sustainable and collaborative future.

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APPENDIX

A. Chapter 2 confidence interval table

a) Pangolin

	Muthi_RRT	Muthi_DQ	TAMSA_RRT	TAMSA_DQ	TAMVN_RRT	TAMVN_DQ
CI high	0.24333	0.044554	0.164255	0.086209	0.013547	0.028302
P	0.165842	0.039604	0.060345	0.068966	0.061321	0.018868
CI low	0.088353	0.003465	-0.04357	0.051724	-0.01271	0.009434

b) Lion

	Muthi_RRT	Muthi_DQ	TAMSA_RRT	TAMSA_DQ	TAMVN_RRT	TAMVN_DQ
CI high	0.821713	0.410891	0.445543	0.327586	0.686014	0.198113
P	0.730198	0.405941	0.321034	0.267241	0.542453	0.188679
CI low	0.638683	0.40099	0.088934	0.293104	0.398892	0.179246

c) Bear

	Muthi_RRT	Muthi_DQ	TAMSA_RRT	TAMSA_DQ	TAMVN_RRT	TAMVN_DQ
CI high	-	-	0.706897	0.563721	0.937094	0.462264
P	-0.0123	-	0.689655	0.37069	0.825472	0.45283
CI low	-	-	0.672414	0.177658	0.713849	0.443396

d) Tiger

	Muthi_RRT	Muthi_DQ	TAMSA_RRT	TAMSA_DQ	TAMVN_RRT	TAMVN_DQ
CI high	-	-	0.505841	0.327586	0.311088	0.028302
P	-0.01238	-	0.318966	0.310345	0.20283	0.075472
CI low	-	-	0.13209	0.293103	0.094572	0.009434

e) Rhino

	Muthi_RRT	Muthi_DQ	TAMSA_RRT	TAMSA_DQ	TAMVN_RRT	TAMVN_DQ
Cihigh	0.24333	0.044554	0.164255	0.086209	0.013547	0.028302
P	0.165842	0.039604	0.060345	0.068966	0.061321	0.018868
Cilow	0.088353	0.003465	-0.04357	0.051724	-0.01271	0.009434

*note that negative estimates can occur for RRT due to the stochastic variability of the forced responses. No data was shown for bears and tigers DQ results, as no trader from *muthi* shop admit to sell these products.

B. Chapter 5 confidence intervals

Figure 5.2.

	CI high	P	CI low
Pangolin RRT	0.367337	0.342784	0.31823
Pangolin DQ	0.066909	0.054945	0.054606
Lion RRT	0.215609	0.195055	0.174501
Lion DQ	0.079581	0.066621	0.066282
Bear RRT	0.351193	0.326923	0.302653
Bear DQ	0.052456	0.041896	0.041557
Tiger RRT	0.226629	0.20567	0.184711
Tiger DQ	0.02578	0.018557	0.018218
Rhino RRT	0.169637	0.151031	0.132424
Rhino DQ	0.062368	0.050824	0.050485

Figure 5.3.

a) Pangolin

	JhB_RRT	JhB_DQ	DRB_RRT	DRB_DQ	PTA_RRT	PTA_DQ	CTP_RRT	CTP_DQ
CI high	0.315078	0.047697	0.4879	0.07021	0.435309	0.152176	0.33956	0.100405
P	0.278381	0.03333	0.4405	0.04989	0.37	0.11111	0.271429	0.066666
CI low	0.024168	0.01897	0.393	0.02957	0.304691	0.070047	0.208901	0.032929

b) Lion

	JhB_RRT	JhB_DQ	DRB_RRT	DRB_DQ	PTA_RRT	PTA_DQ	CTP_RRT	CTP_DQ
CI high	0.442203	0.110089	0.28078	0.01447	0.14441	0.136868	0.159698	0.088537
P	0.376667	0.075556	0.2398	0.0068	0.1175	0.111667	0.114286	0.057143
CI low	0.31113	0.041022	0.19881	-0.0008	0.0909	0.008646	0.068873	0.025749

c) Bear

	JhB_RRT	JhB_DQ	DRB_RRT	DRB_DQ	PTA_RRT	PTA_DQ	CTP_RRT	CTP_DQ
CI high	0.4222	0.06477	0.329734	0.059625	0.400638	0.035044	0.349196	0.082514
P	0.3759	0.04535	0.2925	0.04333	0.336667	0.017778	0.285714	0.052381
CI low	0.3295	0.02593	0.255266	0.027041	0.272695	0.000511	0.222323	0.022247

d) Tiger

	JhB_RRT	JhB_DQ	DRB_RRT	DRB_DQ	PTA_RRT	PTA_DQ	CTP_RRT	CTP_DQ
CI high	0.281113	0.039558	0.213859	0.021153	0.2628	0.02754	0.134493	0.022737
P	0.245826	0.026667	0.163333	0.008889	0.2228	0.01587	0.092857	0.009569
CI low	0.21054	0.013775	0.112808	-0.00338	0.1828	0.00421	0.051221	-0.0036

e) Rhino

	JhB_RRT	JhB_DQ	DRB_RRT	DRB_DQ	PTA_RRT	PTA_DQ	CTP_RRT	CTP_DQ
CI high	0.284524	0.013178	0.250826	0.19037	0.20443	0.013136	0.10316	0.014028
P	0.22561	0.006667	0.196667	0.15646	0.16837	0.004444	0.080551	0.004739
CI low	0.166695	0.000155	0.142507	0.12256	0.13231	-0.00425	0.057942	-0.00455

*note that negative estimates can occur for RRT due to the stochastic variability of the forced responses.

International trade in bear products for Traditional Asian Medicine

Trang Nguyen, Brian Crudge, Rob Ogden, David L. Roberts

Traditional Asian Medicines (TAM) contain plant and animal compounds that may sometimes be derived from endangered species (Cheng et al., 2014; Coghlan et al., 2015). This is a cause for concern among wildlife conservationists as the use of wild animal parts in TAM can put added pressure on populations of many threatened species. It also poses challenges to enforcement agencies, tasked with regulating the trade in endangered species, as the components of TAM are difficult to identify. In Asia, the use of bear bile and gallbladder in TAM is well documented (Crudge et al., 2018; Foley et al., 2011; Gomez and Shepherd, 2018). Studies have also shown that the use of wildlife products in TAM has spread beyond Asia, via the Asian diaspora, to other continents including North America (Petrossian et al., 2016), Australia (Coghlan et al., 2012), and Africa (Nguyen and Robert, in review). Coghlan et al., (2012) found DNA from Asiatic black bear (*Ursus thibetanus*) in TAM products in Australia, and trade of Asian species, such as bear, for TAM purposes was also recorded recently in South Africa (Chapter 2). The aim of the current pilot study was to investigate the animal species composition of TAM products seized in the United Kingdom (UK).

Fourteen TAM products suspected to contain illegal wildlife that had been seized over the last twenty years from shops in London, were provided by the Wildlife Crime Unit of the London Metropolitan Police and subjected to DNA nucleotide sequence analysis for species identification. According to the labels, the TAM products included parts from endangered species such as saiga, rhino, tiger, leopard, lion, bear and pangolin (Table 1). DNA from all samples was recovered using the QIAGEN DNeasy blood and tissue DNA extraction kit, following the manufacturer's instructions. The mitochondrial DNA cytochrome b gene was targeted for sequence analysis as it is known to enable

Table 1: Details of 14 TAM products underwent DNA analysis

Code	Product name	Company	Animal species as labelled	Found England	South Africa
TAM01	She xiang zhuang gu gao	huang shi wei sheng cai liao yao ye you xian gong shi	Leopard	X	X
TAM02	Shexiang Hugu Gao	Liaohe Pharmaceutical Manufactory	Tiger	X	X
TAM03	ZhiTong Gao	China chongqing traditional medicine factory / GuoGuang	Leopard	X	X
TAM04	San Shedan chuanbei ye	GuangZhou Pan Gao Shou Pharmaceutical Co., Ltd.	Snake	X	
TAM05	Unclear	Chendu Xuefeng medicine factory	Panthera.spp	X	
TAM06	Bai Chang Tang	Pak Cheong Tong	Saiga, rhino, bear, monkey kidney stone	X	
TAM07	GuiZhenTang Bear galls	Guizhentang Pharmaceutical company	Bear	X	X
TAM08	Dried bear gall	Unknown	Bear	X	X
TAM09	TzePao Sanpien pills	Yantai Pharmaceutical works	Sea horse, seal, deer, dog, gecko, mantis	X	
TAM10	Peaceful Herb Tea	Tian Jin Herb Manufactor	Saiga	X	X
TAM11	Hu gu jiao	Tong Fu Tang Yao Hang	Tiger	X	
TAM12	Bezoar Antifebrile Pills	Peking Tung Jen Tang	Rhino, deer, saiga	X	X
TAM13	Walk healthily like a stealthy tiger	Da Ren Tang, Tianjin	Tiger	X	
TAM14	Armadillo Antipyretic pills	Wuzhou Pharmaceutical Factory	Pangolin	X	X

diagnostic identification of multiple mammalian species. PCR amplification was first attempted using universal mcb primers (Verma and Singh 2003) and subsequently, for products advertised as containing bear bile, using bear-specific primers, ut172f and ut367r (Peppin et al. 2008). Positive and negative controls were used throughout. Successful PCR amplicons were cleaned using ExoSAP (Thermofisher Inc., USA) and subject to bi-directional Sanger sequencing at Edinburgh Genomics, Edinburgh, UK. Resulting sequence files were edited, aligned and identified to species origin via NCBI BLASTn sequence similarity searches using the Geneious software programme (Biomatters Inc, New Zealand).

DNA sequence results were obtained for two (Sample TAM07 and TAM 08) of the fourteen samples. For sample TAM07, a product labelled as powdered bear gall, manufactured by the Guizhentang Pharmaceutical Company in China, the sequence results identified DNA originating from the Asiatic black bear (*U. thibetanus*). However sample TAM08, labelled as bear gallbladder, and was identified as originating from a domestic pig (*Sus domesticus*). TAM prescriptions often comprise a mixture of ingredients which can hinder PCR analysis. Unfortunately, the other products that were submitted for DNA analysis did not yield amplifiable DNA.

Although we were only able to obtain sequence from two TAM products, this finding is evidence that some individuals have been engaged in international trade of bear bile from China for use as TAM products in the UK. The Guizhentang Pharmaceutical Company, registered in Fujian, China, is known for extracting bile from farmed bears to produce TAM (Jian, 2012). Although bear bile extraction and trade are permitted in China, all international cross-border import or export without proper permits is an infraction of CITES trade regulations (Foley et al., 2011). It is noteworthy that bear products (confirmed with DNA analysis) found over the counter in Australia and bear products observed during market surveys in South Africa were also manufactured by this company (Coghlan et al. 2012; Chapter 2). Among the 14 TAM products analysed here, 8 were also identified in a market survey in South Africa (Table 1) (Chapter 2). Although, it was not possible to obtain these products from South Africa for the

purpose of this study, since the bear products match those from the Guizhentang Pharmaceutical

Company, it is probable that bear products found in South Africa are also genuinely from *U. thibetanus*.

The presence of dried pig gallbladder in the sample provided by the Wildlife Crime Unit of the

Metropolitan Police demonstrates the use of fake products in the TAM trade, although it is not clear

whether or not the seller was aware of its true identity. The practice of advertising gallbladder from

other species is not uncommon. Jabin et al. (2019), using genetic analysis, found that three gallbladders

suspected to be *U. thibetanus* were actually Sambar deer (*Rusa unicolor*) and cattle (*Bos indicus*). The

trade in fake products has been identified as a potential difficulty for regulation and enforcement (Foley

et al., 2011); however, in the UK, simply advertising a product for sale as containing a CITES-listed

species without the correct permits constitutes an offence under CITES regulations, regardless of

whether or not its authenticity has been established. Some countries (e.g. Singapore) have extended

legal restrictions to include fake specimens purported to be from CITES-listed species (Foley et al., 2011).

The presence of fake products has also been shown to be of concern to consumers (Chapter 4).

Asiatic black bears (the species primarily used on bile farms), and majority of other species

products that were included in this study (i.e. rhino, tiger and pangolin) are all listed on Appendix I of

the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Therefore, international commercial trade in these species, their parts, products or derivatives, is

prohibited among CITES member states (including all aforementioned states). International trade in

TAM products containing these species is illegal and demand for them poses a serious threat to species

survival (Graham-Rowe, 2011). This study raises concerns over the scale of the TAM market for

threatened species, such as bear, outside of Asia. It is possible that Chinese migrants smuggle these

products into other regions in order to satisfy the demand of Chinese diaspora communities. However,

this type of demand can also impact wildlife populations outside of Asia. Research by Kennedy et al.

(2018), highlighted the historical trade of brown bear (*U. arctos*) paws at Chinese diaspora sites in

western North America, showing the impact of consumer demand on local wildlife populations. In addition, overall demand for the parts of bears and other species may be increased greatly if consumption behaviours spread to the local non-Asian populace and/or incorporate other wildlife species as substitutes (Chapter 2; Chapter 4).

All fourteen products analysed in this study claimed to include at least one protected species. Without scientific analysis it is impossible to know if manufactured TAM products contain endangered species or were falsely labelled (Baker, 2012; Newmaster et al., 2013). The trade in processed products represents a challenge to effective law enforcement. As seen here, DNA analysis is not always effective at determining species presence. In the absence of consistent, robust methods of species identification for TAM, it is recommended that all CITES member states enact legislation that extends trade regulations to include all parts or products advertised or traded as containing endangered species, irrespective of their actual composition. Our findings contribute to the understanding of the TAM trade in threatened species, particularly of the bear bile/gallbladder trade, driven by the Chinese diaspora.

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D. Published in Biological Conservation

Consumer demand and traditional medicine prescription of
bear products in Vietnam

Elizabeth Oneita Davies, Jenny Anne Glikman, Brian Crudge, Vinh Dang, Madelon Willemsen, Trang Nguyen, David O'Connor, Tuan Bendixsen

Abstract

The illegal trade in wildlife products is a major driver of the global biodiversity crisis. Trade in wildlife products is driven by consumer demand; however, consumer's motivations are often poorly understood. In this study, we use mixed social science approaches to understand the motivations driving consumers of bear products for medicine in Vietnam, and of traditional medicine practitioners who may be influencing consumers. In addition, we provide current information about the ways bear products are used in the two largest cities of Vietnam: Hanoi and Ho Chi Minh City. We found that bear products are still used widely in Vietnam, despite their use being prohibited since 2006. We directly estimated use at 45% of the sample of consumers for Hanoi, and 18% for consumers in Ho Chi Minh City. However, bear products are used differently between the two cities, with Hanoians more likely to take bear medicine products to treat an ailment, versus Ho Chi Minh City, where it is taken as a daily tonic. We also found that some traditional medicine practitioners in Vietnam are continuing to prescribe bear products, despite medicinal prescription of bear bile being made illegal, and availability of traditional medicine herbal alternatives. Generally, use of bear products appears to still be widely acceptable in the country, indicating a need for changing the social norms of bear product consumption. The insights gathered here will be beneficial to conservation managers working in Vietnam and throughout the Southeast Asia region, and will be particularly informative for developing and implementing demand reduction campaigns.

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<u>**E. Published in Oryx**</u>

The challenges and conservation implications of bear bile farming in Viet Nam

Brian Crudge, Trang Nguyen, Cao Tien Trung

Abstract

Legalized trade in commercially farmed wildlife products is sometimes promoted as a conservation strategy. In theory, flooding the market with cheaper or better quality products will decrease the profitability of poaching. Bear bile is highly sought-after for use in traditional medicine and overhunting to supply the demand for bear parts has led to declining populations across South-east Asia. Bear bile farming was established to help supply the high demand for bear bile. In Viet Nam it is legal to keep registered bears, but illegal to extract or sell bear bile. We conducted semi-structured interviews with 66 bear bile farmers in Viet Nam to examine the conservation implications of bear bile farming. The results show that demand for wild bear bile was not satisfied by the widespread availability of farmed bear bile. Farmers report a strong consumer preference and willingness to pay more for wild-sourced products. The existence of bear bile farms presents considerable challenges to law enforcement. The results suggest that bear bile farming in Viet Nam relies on restocking from wild populations, and farmers openly admit to extracting and selling bear bile, in clear violation of national legislation. The case of bear bile farming in Viet Nam provides an example of wildlife farming failing to reduce pressure on a once widely distributed and relatively abundant species. Research into consumer values, attitudes and behaviours will help to improve understanding of market drivers and help inform the design of effective species conservation and management strategies.

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F. Published in TRAFFIC Bulletin

The market for elephant ivory in Cambodia

Trang Nguyen, Jackson L. Frechette

Abstract

This study aimed to evaluate the potentially important and under-studied market for ivory in Cambodia. Market surveys were conducted in June 2015 and January 2016 to assess the number of ivory items for sale, the price of items, and the demographics of the customer base in three Cambodian cities (Phnom Penh, Siem Reap, Sihanoukville). Each city was systematically surveyed to identify ivory vendors. In 2015, 10 retail outlets in Phnom Penh and five retail outlets in Siem Reap were identified as selling elephant ivory, offering a total of 502 and 282 ivory items, respectively. Surveys in January 2016 showed that the number of shops offering ivory had increased to 16 (670 items) in Phnom Penh and eight shops (446 items) in Siem Reap. No elephant ivory was found during either survey in Sihanoukville. Vendors reported that the main consumers of ivory were foreign, particularly Chinese nationals. This study shows that there is a persistent market for ivory in Cambodia, which may be driven largely by foreign buyers from China.

Full article can be access at: https://www.traffic.org/site/assets/files/3018/traffic_bulletin_292-cambodia-ivory.pdf