



What is "TCM"? A conservation-relevant taxonomy of traditional Chinese medicine

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ABSTRACT

The global trade in wildlife affects ~24% of terrestrial vertebrates, and demand for traditional medicinal materials, especially for traditional Chinese medicine, is a high profile driver. Much research has established a causal link between demand for medicinal materials for "TCM" and negative impacts on species conservation and on individual animals' welfare. Key hopes for reducing these impacts are demand reduction and redirection strategies, targetted at consumers and professionals. Conservation research papers routinely treat "TCM" as a homogenous entity, and we argue that in so doing fail to identify distinct markets or communities within "TCM", and that recognising these distinctions would facilitate strategies for demand reduction and redirection. We present an initial taxonomy of "TCM" - using medicinal materials derived from wild animal species as a proof of concept - separating it into three principal components: (a) zhongyi is the broad, all-inclusive medical field representing diverse medicinal materials used in so-called pre-modern and modern medical practice, and described in a number of traditional and revived modern texts; (b) TCM represents a regulated suite of medical and pharmaceutical practises that began to be established from zhongyi in the 1950s and also belongs among zhongyi practices today. Medicinal materials within TCM which represent a curated subset of those within wider zhongyi, are described in the Pharmacopoeia of the People's Republic of China, and are subject to change (for example if trade in a species becomes strictly regulated); finally, (c) CMP, 'Chinese medicine and pharmaco-therapy' is a neo-liberal extension to mainly TCM but also to some aspects of zhongyi. It represents a highly commodified and commercialised form of TCM and zhongyi and includes also some newly designed health products not previously considered 'traditional medical' - let alone 'traditional Chinese medical' - which are dispensed in drug shops, frequently in the absence of a medical practitioner. Practitioners, suppliers and potentially consumers in each category of what in conservation circles is labelled using the blanket term "TCM" are likely to regard themselves as distinct from the others. This appreciation raises the possibility of working with official TCM authorities, professional bodies, academics and practitioners to reduce, and perhaps eliminate, the use of species of conservation and animal welfare concern.

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1. Introduction

The global trade in wildlife affects ~24% of all extant terrestrial vertebrate species on Earth (Scheffers et al., 2019), and is known to be a major driver of species extinctions and animal welfare abuses (e.g. Baker et al., 2013; Challender et al., 2015; Dutton et al., 2013; Fernandes-Ferreira et al., 2012; Grieser-Johns and Thomson, 2005; Pires and Moreto, 2011; Sodhi et al., 2004). The global trade serves a number of sources of consumer demand, among which a principal driver is the use of plants and animals for traditional medicines (Baker et al., 2013). Among traditional medicines, Traditional Chinese Medicine ("TCM") represents a suite of hugely valuable economic markets - within the People's Republic of China (PRC) revenue from "TCM" hospitals has been estimated as \$94.1bn (Chen, 2020b), "TCM" medicine manufacturing as \$25.0bn (Chen, 2020c) and herb growing as \$35.7bn (Chen, 2020a). (Please note that while we here focus on "TCM" in the PRC, "TCM" is consumed in many other countries to which our following arguments equally apply, e.g. Hsu, 2008, 2009). The sourcing of some medicinal materials for "TCM" is reported to have substantial negative impacts on the conservation status of many species (Cheung et al., 2021), and on the welfare of individual animals (Baker et al., 2013; Whitfort, 2020). Demand for wildlife as ingredients for medicinal materials in "TCM" has increased in recent decades, and is projected to continue to do so (Anon, 2019), driven in part by increasing economic prosperity within China (Li, 2020), which has led to increased demand for both native and non-native wildlife products (e.g. Yiwei, 2020), as well as through the active cultural export of "TCM" through the Belt and Road Initiative (Chen, 2018; Zhang, 2018, cited in Hinsley et al., 2020), and inclusion of a chapter on TCM in the latest version of the WHO's International Classification of Diseases - a step perceived as an endorsement by some authors (e.g. Anon, 2019, but see Tilley, 2020, for an alternative perspective). The global market for "TCM" is predicted to reach 5 trillion yuan (approximately 1 trillion USD) by 2030 (Market Insider, 2016), with the accompanying concern that this will increase already severe pressures on wildlife (e.g. Hinsley et al., 2020).

To address conservation and animal welfare issues driven by demand, solutions increasingly incorporate marketing campaigns aimed at influencing the purchasing decisions of consumers, and / or testing whether consumers' attitudes to the consumption of specific products are amenable to being altered (e.g. Courchamp et al., 2006; Dalberg, 2012; Moorhouse et al., 2020; Veríssimo and Wan, 2019). The ultimate goal of such campaigns is to lower demand for products and materials that are damaging to wildlife, and / or promote those that are not (e.g. Macdonald et al., 2021; Moorhouse et al., 2020). Achieving these goals depends critically upon understanding the nature of the target audience, especially with respect to their receptiveness to different approaches and messaging (e.g. Moorhouse et al., 2017, 2020; Olmedo et al., 2018; Veríssimo et al., 2018; Veríssimo and Wan, 2019), because different segments of consumer populations are likely to respond differently to different types of message (Moorhouse et al., 2020; Olmedo et al., 2018; Veríssimo and Wan, 2019). With respect to reducing demand for aspects of "TCM" inimical to wildlife conservation and welfare it is therefore crucial to understand the extent to which "TCM" is segmented into different markets, which may operate through distinct associations of consumers and professionals, and which may have different standards and impacts and be driven by different consumer and supplier motivations. In marked contrast to the abundance of academic studies published in the conservation- and animal welfare-related academic literature on the impacts of "TCM" on species, and/or which seek to assess and remedy these (see references listed in the below sections), few studies have attempted to delineate and describe facets of "TCM" in a manner relevant for wildlife professionals. One recent study provides detailed background information to act as an initial guide for conservation professionals to better understand "TCM" and its authors define "TCM" as follows: "For the purposes of this paper, our use of "TCM" is in keeping with both current official Chinese sources and the common usage of the term in conservation circles, encompassing the wider 'Chinese medicine and the pharma-industrial complex' within and beyond China's borders" (Cheung et al., 2021). Here, as indicated by Cheung et al. (2021), we argue that common usage of the term "TCM" by conservation professionals encompasses, and fails to distinguish between, several distinct suites of practices and - potentially, therefore - consumer bases with accompanying motivations. To differentiate these we present a categorisation and topographical overview of TCM, highlighting aspects of relevance to conservation and animal welfare. Our intention in doing so is that the information can be used to appropriately target behaviour-change endeavours that intend to redirect and reduce the use of species of concern. The wider hope is that more nuanced understanding of "TCM" could give rise to dialogue and linkages between "TCM" professionals, practitioners and academics, and those seeking to mitigate conservation and animal welfare impacts.

To achieve our goal we employ a transdisciplinary approach, drawing from the fields of anthropology and conservation science. We first present a brief history and taxonomy of "TCM", drawing from the published literature. From this we derive a diagram that compartmentalises "TCM" into distinct facets of relevance to the use of animal-origin materials in medicinal preparations. Then, in support of this diagram, we present the results of interviews with "TCM" practitioners and experts. These interviews were stratified among professionals working in large, multi-community practices (e.g. "TCM" hospitals or urban medical centres) and those situated in rural communities, to give an indication of the breadth of support for our classification.

Throughout we focus specifically on the use of animal species as medicinal materials (as opposed to including plant- or mineral-origin medicinal materials) in different facets of "TCM". We maintain this focus on animal-origin medicinal materials as a proof of concept, because their use is often higher profile, and limited to a far smaller number of species, relative to plant-origin materials (e.g. Cheung et al., 2021). Similarly, we are concerned both with species conservation and impacts on animals' welfare, the latter of which does not apply to plant species.

2. Literature review

2.1. Differentiating between “TCM”, *zhongyi*, TCM, and CMP

The term “TCM” is used by species conservation and animal welfare professionals as an all-embracing term for many different facets of Chinese medicine (see also next section). Here we distinguish between those facets.

The broad medical field of *zhongyi* is commonly referred to as ‘Chinese medicine’ or as ‘traditional Chinese Medicine’; it was termed tCM by Taylor (2005) but we refer to it only as *zhongyi* to permit ease of distinction from other terms. *Zhongyi* is an all-embracing, and ahistorical term, and from it we distinguish TCM (Traditional Chinese Medicine) and CMP (Chinese medicine and pharmaco-therapy, *sensu* Hsu, 2008) (see Table 1). TCM is entirely embedded in *zhongyi* and began to be established by the Communist government in the 1950s by regulating practices and medicinal substances (Taylor, 2005; Chen, 2021; Hsu, 2008). By comparison CMP overlaps with TCM and *zhongyi* but also includes practices and medical materials not previously considered traditional Chinese medical: the industrialised products of *zhongyiyao*, termed CMP by Hsu (2008). Whereas TCM considers itself to be modernising an ancient ‘Chinese science’, which emphasises holism and living in harmony with one’s environment, CMP aims to cater to a global science that works to materialistic goals, with extractive technologies, and does so at very high speed (Hsu, 2008).

Taylor (2005) has much substantiated, using archival and fieldwork-based research, the long-standing argument that the government of the PRC initiated the establishment of TCM in the 1950s. More recent historical developments raised the suggestion of distinguishing between TCM as a nationalistic ‘invented tradition’, promoted from the 1950–1980s, and CMP as an ‘alternative modernity’ (Knauf, 2002) or ‘global assemblage’ (Collier, 2006), promoted by the Chinese government in the twenty-first century, both for inland and global markets (Hsu, 2008).

It is in this context of commodified global health that the term *zhongyiyao* (here termed CMP) arose in the PRC. TCM as originally conceived made a strong appeal to China’s cultural heritage, but this has latterly been overridden by the commercial potential of CMP and its aim to be recognised by the globally accepted biosciences. An economically strong middle class clientele is driven by a belief in personal agency and individual responsibility, contributing to industrialised pharmaceutical production of Asian medicines in general (e.g. Pordié and Gaudillière, 2014; Chen, 2021) and ‘Chinese industrialised medicines’ (*zhongchengyao*), in particular (e.g. Hsu, 2009; Table 1), becoming commercially lucrative. These industrialised medicines, which were developed within the Maoist programme of integrating Chinese and Western medicine (*zhongxiyi jiehe*), are currently flourishing on the neo-liberal health markets both in the southern and northern hemisphere (Hsu, 2009). Whereas TCM typically requires a doctor-patient relationship, with prescribed treatments, CMP flourishes in semi-regulated health fields in which health food shops have gained a strong foothold, and over-the-counter transactions and web purchases of non-licensed drugs for both preventive and curative purposes have become frequent (Hsu, 2008, 2009). The advice of the medical practitioner is often not heeded within CMP. Instead, partially as a novel addition to the long-standing tradition of self treatment in China, patients often diagnose and treat themselves based on information from the media, the internet and the advertising industry. (Such transactions are somewhat analogous to over-the-counter medicines and health products available to Western consumers, who can source these from pharmacies and/or health-food suppliers.) By bypassing the authority of the doctor, who is meant to act as responsible gatekeeper, both the health food and pharmaceutical industries can reach their clientele directly (Hsu, 2008), and with increasing precision.

Table 1
The definition of “Official TCM” and related terms.

English term	Chinese term	Definition of term
OTCM		Official TCM (OTCM) is the modern form of TCM (see below), which began to be established by the Communist government in the 1950 s by regulating practices and medicinal substances within the Maoist programme of integrating Chinese and Western medicine (<i>zhongxiyi jiehe</i>). This represents a curated subset of the wider set of medicinal materials and practices within <i>zhongyi</i> . Medicinal materials are those listed in the Pharmacopoeia of the People’s Republic of China. OTCM requires a doctor-patient relationship, with trained TCM doctors, and TCM hospitals, and prescribed treatments. Practitioners trained in oTCM are likely to integrate elements of CMP into their practice.
"TCM"	NA	Traditional Chinese Medicine as used in species conservation and animal welfare literature. This term typically makes no differentiation between the roles of different professionals or bodies, and typically also fails to differentiate between the potentially very different markets and consumer bases - and their level of legal and professional oversight - that exist within "TCM". As such the term encapsulates all the impacts of OTCM, <i>zhongyi</i> and CMP without distinguishing between these different facets.
<i>zhongyi</i>	<i>zhongyi</i>	An all inclusive term: Chinese medicine, comprising diverse medicinal materials described in traditional and modern texts. Some "TCM" practitioners may opt to focus more on traditional texts, and use more of the medicinal materials listed therein.
TCM (1950s phenomenon)		TCM began to be established by the Communist government in the 1950 s by regulating practices and medicinal substances within the Maoist programme of integrating Chinese and Western medicine (<i>zhongxiyi jiehe</i>). TCM represents a curated subset of the wider set of medicinal materials and practices within <i>zhongyi</i> .
CMP (1990s phenomenon)	<i>zhongyiyao</i>	A neo-liberal extension of TCM, in which Chinese industrialised medicines were developed within the Maoist programme of integrating Chinese and Western medicine (<i>zhongxiyi jiehe</i>). These medicines form neo-liberal health markets both in the southern and northern hemispheres. Whereas official TCM typically requires a doctor-patient relationship, with prescribed treatments, CMP flourishes in semi-regulated health fields in which health food shops have gained a strong foothold, and over-the-counter transactions and web purchases of non-licensed drugs for both preventive and curative purposes have become frequent.

The above discussion leads to a classification of facets of traditional Chinese medicine in which zhongyi refers to the broad medical field, which has a long, still ongoing history incorporating multiple sources of tradition and knowledge, from scholarly texts to folk medicine, and TCM refers to the “official”, regulated suite of medical and pharmaceutical practises that began to be established from zhongyi in the 1950 s, as practised by trained TCM doctors in TCM hospitals and large, cross community practices. CMP refers to a neo-liberal extension to TCM and zhongyi and also incorporates practices and substances previously not considered either TCM or zhongyi. Examples of the latter are new medicines derived through biotechnology and marketed by pharmaceutical companies, or species substitutions for existing materials, as has occurred for example with lion bones, which are commonly substituted for tiger bones, often unbeknown to end consumers (Moorhouse et al., 2020; Macdonald et al., 2021). CMP materials and practices therefore represent neologisms, either because the materials have no prior history of usage, or because the application of commercial forces to existing materials results them being consumed in disproportionately greater quantities than would be expected from their previous usage. These categories, described in Hsu (2008), provide a useful framework for understanding components of “TCM” that are highly relevant to understanding the impact of “TCM” on conservation and animal welfare. Note also that while the concepts underlying the above categories are able to be sharply defined, the boundaries between them in reality are often blurred. As an example, many modern TCM practitioners may view themselves as adherents of (and trained in) official TCM, but their training and daily practice may now incorporate many components of industrialised Chinese medicines that ultimately derive from CMP (e.g. State Council Bulletin, 2020). Hereafter we use the above terminology to delineate different facets of what wildlife professionals call “TCM”, which include in addition to TCM, the practices and substances of zhongyi and CMP.

2.2. "TCM" as represented in the species conservation and animal welfare literature

The negative impacts for species conservation, and individual animals' welfare, of a species' use in "TCM" are detailed in a large and growing literature that links demand for traditional medicinal and healthcare ingredients with global declines in species abundance (e.g. Challender, 2011; Challender and MacMillan, 2014; Crudge et al., 2018; Davis et al., 2019; Goodrich et al., 2015; McClenachan et al., 2016; Nijman et al., 2016; Nowell and Xu, 2007; Pantel and Chin, 2009), and with the capture, transport, captive breeding, slaughter and sale of wild animals under conditions that give rise to negative animal welfare impacts (Baker et al., 2013; Macdonald et al., 2021; Whitfort, 2020). “TCM” however, comprises an evolving and multi-faceted constellation of traditional health-related practices, not all of which tightly adhere to developments of the central, formal discipline. As such there is considerable potential for different practitioners and consumers to belong to different markets that may have very different drivers of, and attitudes towards, their usage of species of conservation and welfare concern. Similarly, the motivations of professionals within different markets are likely to be very different - although it would be misguided not to acknowledge grey zones and blurred boundaries between these. Polemically put, professionals who practise official TCM would have a primary focus on successfully treating patients, whereas those engaged with CMP would have a primary focus on entrepreneurial goals (Hsu, 2008), notwithstanding that doctors may also experience financial incentives when prescribing treatments (e.g. Chen, 2007; Yip et al., 2020). Professionals involved with CMP must satisfy consumer demand for healthcare products, demand for which is unlikely to be driven wholly by medical exigence, but which is also heavily influenced by advertising from pharmaceutical companies and trends on social media. Such key differences are rarely, if ever, acknowledged in the academic conservation and welfare literature, in which “TCM” is typically used as a catch-all term to describe Chinese medicine (see e.g. Challender et al., 2019; Chang et al., 2013; Chen et al., 2015; Chi et al., 2017; Cunningham and Long, 2019; Dutton et al., 2011; Gratwicke et al., 2008; Hinsley et al., 2020; Liu et al., 2015, 2016; Moorhouse et al., 2020; Vincent et al., 2011, and papers within Misc, 2000). Among this sample of papers, for example, only one mentions that “TCM” is likely to involve both a formal sector, represented by ‘well-trained professional practitioners using official products’, and an informal sector ‘of opportunistic traders and untrained practitioners’ (Hsu, 2013, cited in Hinsley et al., 2020). In view of significant overlap between TCM and CMP as well as zhongyi, it is no surprise that the majority of conservation practitioners and scientists make no differentiation between these in their use of terminology. We here draw attention to the issue not as a criticism of any of the above publications or authors, but to highlight - through judiciously coined terminology to highlight differences in orientation - an opportunity for the future, to better understand the nature of a key driver of conservation and animal welfare issues.

2.3. A taxonomy of "TCM" relevant to animal conservation and welfare

In Fig. 1 we present a schematic delineating broad aspects of “TCM” of relevance to animal-origin medicinal materials. We differentiate between three broad categories: (1) medicinal materials in current use as “TCM”, for which evidence exists of current purchase and consumption within China, but which may or may not have prior textual evidence of their use (shaded red); (2) zhongyi materials for which textual evidence of their traditional use for medicinal purposes exists (for example, Chinese medicinal materials like tiger bone listed in older texts and contemporary academic sources), but which may or may not be currently consumed as “TCM” (shaded blue); and (3) materials which are listed in the “official” Pharmacopoeia of the People's Republic of China (shaded green), which notably changes with every new edition, and represents a grey-zone area.

All three categories intersect in Zone A. This zone contains animal-origin medicinal materials that are currently being consumed, which have a history of use that is recorded in pre-twentieth century, as well as in newly authored Chinese medical texts (comprising folk practice descriptions and scholarly treatises) and which are also approved by the Pharmacopoeia of the People's Republic of China (e.g. Siberian musk deer, *Moschus moschiferus*, Saiga antelope, *Saiga tatarica*, great seahorse, *Hippocampus kelloggi*). Medicinal materials in this zone are used in official TCM medicines and likely to be prescribed by TCM doctors in major TCM hospitals and clinics. In our schematic medicinal materials falling outside of Zone A depart from being “official TCM” (see Table 1) by varying degrees.

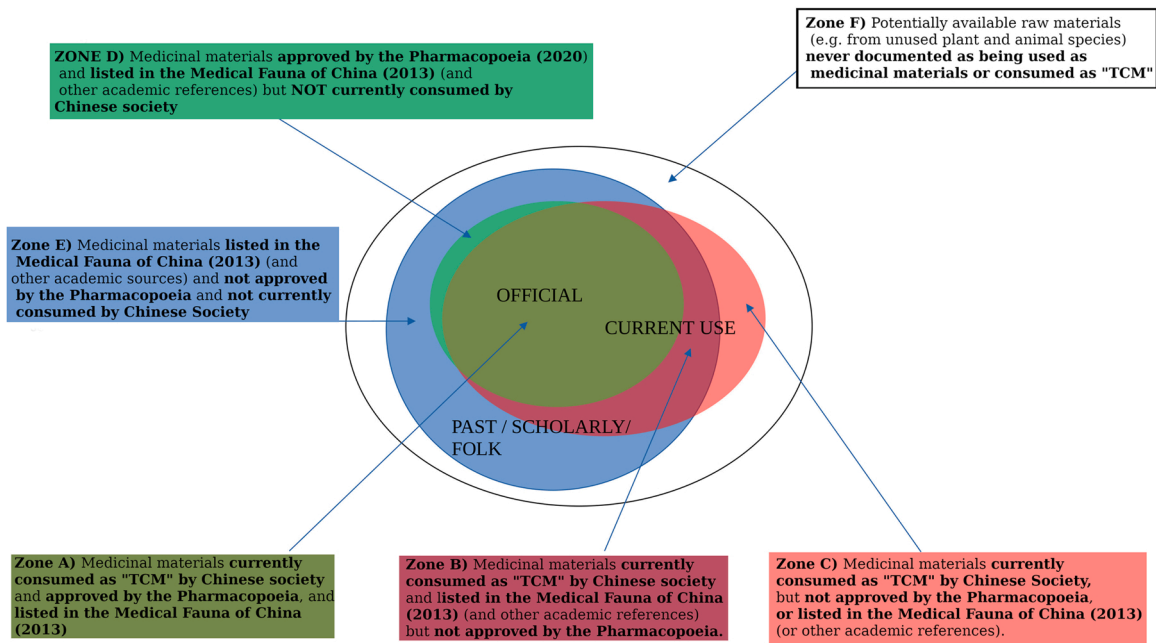


Fig. 1. A diagrammatic representation of the interrelationship between different facets of "TCM".

Medicinal materials in Zone B are currently consumed, and have a history of use recorded in pre-twentieth century texts, but are not currently listed in the Pharmacopoeia of the People's Republic of China. These materials belong to "Chinese medicine" (zhongyi), but are not currently approved for use within the official TCM (e.g. golden coin turtle, *Cuora trifasciata*, Chinese stripe-necked turtle, *Mauremys sinensis*, Burmese python, *Python bivittatus*, sun bears, *Helarctos malayanus*, brown bear, *Ursus arctos*, and Asian black bear, *Ursus thibetanus* – see Moorhouse et al., submitted).

Those in Zone C are currently being bought and consumed, and usually do have prior textual and oral histories but have witnessed a disproportionate recent rise in usage, as a result of, perhaps, biotechnological interventions (i.e. they are to some extent new creations, or species used as substitutes for listed species, for example Siamese crocodile, *Crocodylus siamensis*, or lion bone, *Panthera leo*). These belong among CMP products in our above classification and are generally exclusively purchased in the context of practising CMP (CMP, meanwhile, also may include medical materials commonly used by officially trained TCM practitioners too).

Those in Zone D are medicinal materials approved by the Pharmacopoeia, but no longer used or consumed. Since the Pharmacopoeia is regularly updated, this is only likely to occur in the interim between trade in a listed material being made illegal and a new edition being produced (e.g. fermented tiger bone, which was made illegal in 1993 – [State Council Bulletin \(2020\)](#) – and was last listed in the Pharmacopoeia in 1977). An illegal trade may of course continue in the interim, evidence of which exists e.g. for tiger bone ([Shao et al., 2021](#)), and such a medicinal material may still (illegally) be consumed after removal from the Pharmacopoeia, but now as zhongyi or CMP, not as official TCM. In general, however, all animal species listed in the Pharmacopoeia are likely to be consumed.

Those in Zone E are zhongyi medicinal materials not (or no longer) listed in the Pharmacopoeia, but described in pre-twentieth century texts, which are no longer used or consumed.

Zone F contains all the remaining animal species that have no current or prior usage within any facet of "TCM".

It is important to note that the relative numbers of types of medicinal materials that fall into a given zone are likely to vary greatly, as is the quantity of any given medicinal material that is consumed. Within Zone A (currently consumed official TCM), for example, 70 animal species are listed within the Pharmacopoeia ([Moorhouse et al., in press](#)), Zone D (official TCM not currently consumed) may have very few or no representatives at any given time, while Zone B and Zone E (zhongyi species, respectively currently consumed and not consumed) divide between them - in unknown proportions - the 2275 animal species listed in the Medical Fauna of China, as well as additional species listed in further texts.¹

¹ In this context please note that a large proportion of the Chinese population is likely to consult unofficial medicinal providers and/or to use home-based remedies and self-help practices – and such practices are not novel, dating from at least the early modern period. The degree to which such self-treatment practices create conservation and/or animal welfare issues within "TCM" will depend upon the nature and quantities of species being sourced to meet the demand these practices create. For these purposes the types and quantities of medicinal materials that feed into such demand are likely to be indistinguishable from those that arise from zhongyi practises in general (Zone B). Such demand is distinct from that caused by novel, industrially produced zhongchengyao, CMP (Zone C), because medicinal materials within CMP (which have been created to treat disorders ranging from stomach ulcers to infertility) represent neologisms, either due to the novel nature of the medicinal materials themselves, or because current rates of their consumption are novel (i.e. commercially accelerated).

In summary Fig. 1 divides animal-origin medicinal materials between three types of Chinese medicine, or what the above authors enumerated in the above section call “TCM”, and two categories of use. Animal origin medicinal materials can belong to official TCM, traditional and contemporary zhongyi, or neo-CMP, and are either currently used (prescribed, bought and consumed), or not currently used.

2.4. Conduct and results of expert elicitation interviews with Chinese medical practitioners

Over a one month period 25/07/2020–25/08/2020 we approached eleven Chinese medical practitioners drawn from a spectrum of settings and who represent a range of specialisations. Informants were drawn from a number of different geographic locations, including Hubei, Shaanxi, Sichuan and Yunnan provinces. We wished to assess their level of agreement with our representation in Fig. 1. We also sought to understand whether these professionals considered there to be a widely accepted definition of TCM, on what sources they might base that definition, and whether they considered that there could be some animal or plant origin materials that were bought due to popular demand, rather than because they were medically effective. Additionally, to understand the extent to which traditional medicinal materials are considered substitutable with alternate species (i.e. those that have no prior history of usage within any facet of “TCM”), we presented interviewees with a list of species that are traded for “TCM”, but which are unlisted in the Pharmacopoeia or prior texts (see Shao et al., 2021). These species were: Malayan pangolin (*Manis javanica*), African elephant (*Loxodonta spp.*), lion (*Panthera leo*), North American beaver (*Castor canadensis*), red eared slider (*Trachemys scripta elegans*) and African cobra (e.g. *Naja melanoleuc*). All research protocols were subject to ethical approval, reference R69892/RE001, Oxford University CUREC.

Due to practical restrictions resulting from the COVID-19 pandemic, interviews were conducted either as socially distanced face-to-face interactions or via emailed question sets. Full questions and responses are presented in Table S1. We received full responses from two professors at Chinese medical universities - one of whom was also a practising doctor at a TCM hospital - one pharmacist at a Chinese medical university, a pharmacist at a TCM hospital, two doctors working in TCM hospitals, two doctors working in country clinics, two doctors who work in TCM drugstores, and a herbal medicine seller (see Table S1). Our respondents therefore grouped approximately into those working in cross-community practices (e.g. in TCM hospitals) and those working within single communities (those in country clinics, drugstores and the herbal medicine seller).

Our key question was whether, and how, respondents felt that Fig. 1 could be improved as a representation of the relationship between types of animal-origin medicinal materials and different aspects of Chinese medicine. Eight respondents stated they believed the diagram to be reasonable. Of these six suggested no improvements and one suggested a minor revision: to remove section F as this was felt to be too inclusive to be meaningful. The eighth respondent stated that the diagram was reasonable but suggested alterations. This respondent stated that the diagram should divide medicinal materials into only “official” and “folk” medicines. The reasoning was because: “...all traditional Chinese medicines are historical medicinal materials, while academic research is a method to prove the medicinal value of TCM. As a result, the official list refers to these medicinal materials which are included in official sources, and the folk list refers to those medicinal materials which are listed in the ancient and modern reference books, in addition to official medicinal materials”. The respondent also suggested that “official sources” for TCM should not only include the People’s Republic of China but also Provincial Standards of TCM and Local Standards of TCM. The three remaining respondents chose not to comment on our diagram, stating that they were uncertain. All of these latter respondents operated in single-communities (two doctors operating in a drugstore, and one in a community clinic), as opposed to in large, cross-community practices.

We detected differences in the responses of the two groups of respondents in the modernity of the texts they cited in further questions, in support of their knowledge of TCM. When asked which reference texts they base their definition of TCM on, we received responses from four cross-community respondents who made three references to two modern texts and two references to two traditional texts (Table 2). By comparison, single community professionals favoured traditional text sources, making seven references to five traditional texts, compared to two references to two modern texts (Table 2). Similarly, while all respondents agreed that the term “TCM” includes materials listed outside of the Pharmacopoeia of the People’s Republic of China, the cross-community professionals favoured modern sources, listing as examples five references to four modern texts, compared with three references to three traditional texts. Single community professionals made two references to one modern text and one reference each to eight traditional texts (Table 2). Albeit from a small sample, our data reveal a marked difference in the type of text on which TCM professionals were basing their knowledge: cross-community professionals favoured modern texts by a ratio of 8:4 (2:1) references, while single-community professionals favoured traditional texts by a ratio of 15:5 (3:1) references (Table 2), with one of the latter respondents stating that they had not read the Pharmacopoeia of the People’s Republic of China.

Only three respondents provided an answer to our question regarding species substitutions. Of these, a Professor at a TCM University stated that species of the same genus as existing medicinal animals are part of “TCM”, and can be used - and so all six of the alternative species we presented should be able to be used for “TCM”. This view was shared by a doctor from a single community drug store, who also agreed that all six species were “TCM”. Contradicting these responses, a Pharmacist in a TCM hospital stated that only African elephant skin and North American beaver could be used for “TCM”, because textual precedent exists for their usage: North American beaver is recorded in the Great Dictionary of Chinese Medicine and African elephant in the Manual for Identification of Modern Chinese Medicinal Materials. The other species could not be used for “TCM”, given no prior textual support for their usage.

In summary, seven of the eight respondents who gave an opinion on our diagram stated that they believed it to be a reasonable representation of the interrelationship between facets of Chinese medicine that use animal-origin materials, and suggested no alterations. The other respondent suggested that we should have draw a distinction only between folk medicines and official TCM (as opposed to including academic sources in our definition of zhongyi). This latter suggestion does not disagree with the creation of

Table 2

Numbers of references made to modern and traditional TCM texts by cross community and single community TCM professionals, when asked to identify the sources of information on TCM they use.

Text	Modern or Traditional	Cross community references	Single community references	Total references
Pharmacopoeia of the People's Republic of China (中国药典)	Modern	2	1	3
Processing Standard of Chinese Herbal Pieces in Hubei Province (湖北省中药饮片加工标准)	Modern	2	0	2
The Study of Formulae (方剂学)	Modern	0	3	3
Manual for Identification of Modern Chinese Medicinal Materials (现代中药材鉴定手册)	Modern	1	0	1
Great Dictionary of Chinese Medicine (中药大辞典)	Modern	1	0	1
The Theory of the Fundamentals of TCM (中医基础理论)	Modern	1	0	1
New Edition of the Systematically Classified Medicinal Materials (本草纲目新编)	Modern	1	0	1
	Sub-Total	8 (66.7%)	4 (33.3%)	12
Compendium of Materia Medica by Li Shizhen (本草纲目)	Traditional	2	3	5
The Divine Husbandman's Medicinal Materials (神农本草经)	Traditional	1	2	3
The Study of Medicinal Materials (中药学)	Traditional	0	3	3
Four Hundred Kinds of Medicines (药性四百味)	Traditional	0	2	2
Drug Properties in Verse (药性赋)	Traditional	0	2	2
Treatise on Febrile Disorders (伤寒论)	Traditional	1	1	2
Outline of the Essential [Formulae] Kept in the Golden Casket (金匱要略)	Traditional	1	1	2
Inner Canon of the Yellow Emperor (黄帝内经)	Traditional	0	1	1
	Sub-Total	5 (25.0%)	15 (75.0%)	20

categories that distinguish official TCM from traditional and popular usages, but with where these categories should be drawn. On the basis of this evidence we suggest there was broad agreement for distinguishing categories within "TCM" and for our representation of the differences between official TCM, all-embracing zhongyi - inclusive of traditional and modern texts - and neo-liberal CMP. Opinion was divided on whether species were permitted to be consumed as "TCM" if lacking prior textual support, with two respondents suggesting that species within the same genus were substitutable, and another suggesting that this was not the case.

2.5. Synthesis and recommendations

The conservation and animal welfare literature routinely reports that the use of species for "TCM" is a high profile driver of the global trade in wildlife. This is demonstrably true in the generality for a substantial number of species, but we argue that inexact use of the term "TCM" means that studies routinely fail to account for the existence of distinct facets of Chinese medicine that may have very different impacts on wild populations, and indeed on public health. These facets vary in their degree of legal oversight, the species they use as medicinal materials, the methods and scale of sourcing of materials, and the extent to which the consumption of those species is likely to be driven by popular demand (see also Moorhouse et al., in press). We note, however, that legality, and oversight do not automatically guarantee sustainability, good animal welfare, or biosecurity of a given medicinal material (e.g. Macdonald et al., 2021). We argue that such imprecision comes with a potentially substantial penalty with respect to the correct targeting, and therefore effectiveness, of social marketing interventions designed to redirect and or reduce consumption of species of concern.

As a first step towards formalising for wildlife professionals the distinctions that exist within "TCM", and encapsulating the complexity of the interrelationships between its constituent markets, we recommend the wider adoption of existing terminology that distinguishes between the different facets of "TCM". These terms are outlined above and collected in Table 1. In Table 1 we draw a further distinction, between TCM as initially conceived in the 1950s, and official TCM (OTCM) in its present form (as presented in Fig. 1). We here coin the term OTCM (as distinct from TCM as a 1950s phenomenon) to highlight that today's formally trained official TCM practitioners - knowingly or not - incorporate into their practice components of industrialised Chinese medicine that ultimately derive from CMP (e.g. State Council Bulletin, 2020). To this extent OTCM differs from TCM as it was first conceptualised in the 1950s, because it now incorporates many neoliberal, commercial elements (Table 1). CMP itself may be viewed as a historically logical development within TCM, which has vastly increased revenues, integrated biotechnology to modernise TCM and its image, and also, through trade, integrated marginal populations such as pangolin hunters in India and elsewhere (D'Cruze et al., 2018) or collectors of plant resources, who previously were not part of the global economy due to living in remote, relatively inaccessible areas (Hamilton, 2004; Sheng-Ji, 2001). In so doing it has resulted in OTCM. These innovations, although beneficial for Chinese medicine's economic and geopolitical status, have also increased the risk of significant disbenefits in the form of unsustainable impacts on species' populations and/or on the welfare of individual animals. We coined the term OTCM to highlight that while many of the negative impacts on animals arise from the sheer volume of raw materials required for practising CMP, and therefore from outside of the doctor/patient relationship - e.g. from some of the entrepreneurial activities of health product and pharmaceutical suppliers and the intermediary traders - there nevertheless exist aspects of OTCM that also give rise to negative impacts. Put another way, the physicians practising OTCM often have education and social status that those who become involved in the trade of CMP do not have (Hsu, 2013), and the extensively neo-liberal nature of CMP means that the degree of regulation and legal oversight of the materials being processed and

consumed is likely to be weak, relative to many involved in OTCM. Having said this, in OTCM too existing levels of usage and oversight are still currently insufficient to guarantee the absence of negative impacts on wildlife. (Please note that these distinctions are made here in order to intellectually distinguish facets that have relevance to species conservation and animal welfare, but within the PRC, CMP and OTCM are typically both simply called TCM.).

The animal-origin medicinal materials available for practitioners of OTCM are those listed in the Pharmacopoeia of the People's Republic of China (e.g. Fig. 1), and amount to 70 species (see Moorhouse et al., *in press*). Among the Chinese medical practitioners we interviewed there was broad agreement with our diagrammatic representation of the interrelationship between OTCM, zhongyi and CMP (Fig. 1), but all practitioners also agreed that "TCM" as they conceive it incorporates medicinal materials beyond those listed in the Pharmacopoeia. The nature of the texts they gave as a basis for their knowledge differed between those working in cross-community settings, who were more likely to refer to relatively modern texts, and those in single-community settings who referred more often to traditional texts. We present this observation to demonstrate the effect of blurred boundaries between our categories: many of our respondents may view themselves as adherents of OTCM, but nonetheless may use medicinal materials that derive from a broader understanding of Chinese medicine.

Taken together these observations imply that the aspects of "TCM" often discussed in the conservation and animal welfare literatures arise primarily from the neoliberal practices of CMP, including wasteful industrial production procedures and global trading of previously unseen size and scale and velocity (Hsu, 2008). From a conservation perspective this trade encompasses species known to already be threatened with extinction (for a number of causes, not necessarily originating in that trade) and species for which we lack the data required to understand whether that trade is / can be sustainable (e.g. Macdonald et al., 2021). From the perspective of safeguarding animal welfare, a number of species exist for which various practices (e.g. those relating to capture, farming, or product preparation for the provision of medicinal materials) incur animal welfare costs that are deemed untenable.

In addressing these, given the status and formal training of OTCM practitioners, it is potentially beneficial to collaborate with them to remove some of the excesses of CMP from their educative and clinical practice - as a first step by substituting animal species threatened by extinction with sustainably sourced plant alternatives, an approach likely to be accepted by their patients (Moorhouse et al., 2020). Doing so may begin to mitigate concerns from the global community over the impacts of the use of plants and animals within Chinese medicine, while also mitigating the risk of conservation and welfare initiatives being perceived as a cultural attack on OTCM itself, and on the Chinese medical intelligentsia. But beyond this specific recommendation - and cognisant that the influence of the pharmaceutical industry and the behaviour of consumers of non-official treatments (e.g. self-treatment or informal healers) should not be ignored - understanding the structures relating to "TCM" sufficiently to correctly target conservation and animal-welfare initiatives may permit engagement with a wider community of professionals to encourage change from within.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at [doi:10.1016/j.gecco.2021.e01905](https://doi.org/10.1016/j.gecco.2021.e01905).

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