16 March 2019

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RH：Wang et al. • Captive Breeding of Wildlife

Captive Breeding of Wildlife Resources—China's Revised Supply-side Approach to Conservation

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ABSTRACT The conservation and utilization of wild animals in China often raises public concerns. Thus, the Chinese government is increasingly exploring sustainable development of wildlife resources, and has implemented a series of measures, such as the modification of

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the Wildlife Protection Law (WPL), implementation of captive breeding licenses, an animal marking system, forest certification, and other actions to regulate captive breeding and utilization of wildlife. At the same time, the government tries to meet the Chinese traditional demand for wildlife products. We first introduce wildlife utilization as an internationally accepted conservation tool, and describe market-based wildlife farming as a legal substitute for wild-hunted animals. Second, we highlight the importance of wildlife products in Chinese culture and economy and review some successful examples of wildlife utilization in China, showing that the supply-side approach is a viable alternative to classical conservation. Subsequently, we outline benefits of and drawbacks to China's 'conservation through utilization' approach, resulting in the implementation of China's new, revised WPL. We discuss merits and shortcomings of China's revised WPL and respond to recent national and international criticism on China's supply-side approach to conservation. We strongly propose that captive breeding for utilization is a feasible approach to China's wildlife conservation dilemma, but we are also aware that considerable efforts are still needed to promote this progress, i.e. implementing government legislation the allocation of tasks and duties, and the creation of public awareness.

KEY WORDS Chinese Wildlife Protection Law, conservation through utilization, game farming, mammals, wildlife consumption.

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Wild animals are an important part of our global ecosystems and an indispensable resource for human life. Since ancient times, wild animals and their products have played an important role in the evolution of man and the development of human civilizations, eventually leading to the domestication of today's livestock and pet species (Harding and Teleki 1981, Diamond 1997, Clutton-Brock 1999). Gazelles (*Gazella* spp.) were kept in ancient Egypt and the Middle East for meat production and as pets (Legge 1972, Wronski et al. 2017); reindeer (*Rangifer tarandus*) were—and still are—herded in the artic for the production of food, clothes and tools (Sturdy 1975); and, in China, bears (Asian black bear, *Ursus thibetanus*; brown bear, *U. arctos*; Malayan sun bear, *Helarctos malayanus*) were kept to produce bear bile for more than 3,000 years (Huang and Li 2006, Bacon 2008).

With continuous growth of the global human population and rapid development of agricultural and industrial land-use practice, many wildlife species are seriously threatened, if not extinct (Angelici 2016, Daleszczyk et al. 2016). However, in recent decades, the ecological and social value of wild animals are increasingly recognized by government bodies, nongovernmental organizations (NGOs), media and the general public (Sekercioglu 2006, Clucas et al. 2008, Meng 2008). Institutions and societies pay greater attention to the increasing destruction of habitats and the extinction and decline of species. This led to a more scientific approach to conservation and sustainable utilization of wildlife resources, such as ecotourism, trophy hunting or game ranching (Isaacs 2000, Loveridge et al. 2006, Lindsey et al. 2007, Lindsey et al. 2009). For the survival of threatened species, it became increasingly important to not only protect them and their environment *in situ*, but to look for alternative ways such as the intensive breeding for re-introduction or even production (Hudson et al. 1989). This however, demands strict regulations to develop and coordinate the relationship between conservation and global demand for wildlife products.

In recent decades, the international conservation community increasingly recognized the utilization of wildlife as a tool for the conservation of biodiversity and defined several types of sustainable wildlife utilization (van Hoven and Ebedes 1994). In 1980, the International Union for the Conservation of Nature and Natural Resources (IUCN) developed a new 'World Conservation Strategy' that illustrated an alternative idea by putting the sustainable use of wildlife resources in the focus of their activities, resulting in a more formal 'Policy Statement on Sustainable Use of Wild Living Resources' (IUCN 1980, 1991, 2000). Moreover, in their 'Strategic Plan 2008-2013', the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES) recognized that through the sustainable use of wildlife, a significant contribution to the economic concerns of developing countries can be achieved (Abensperg-Traun 2009). The CITES further emphasizes that all contracting nations should carry out sustainable trade of wildlife products, but prevent the excessive exploitation and unsustainable utilization of wildlife resources in their countries (Jiang 2003). Applying this so-called supply-side approach to conservation suggests that species conservation can be most effectively achieved by legalizing and regulating the market of wildlife products (Phelps et al. 2013). According to supply-side economics, consumers will then benefit from a greater supply of wildlife products at lower prices, employment will increase but wild take will decrease. However, applying this approach to conservation remains a dialectical issue with opponents arguing that a legal market would be misused for laundering of illegal products into the commercial trade and leads to a reduction of stigma towards illegal consumers (Eltringham 1984, 1994; Makombe 1994; Kock 1995; Tisdell 1994; Croft 2000; Fischer 2004; Tensen 2016).

The most intensive form of wildlife utilization is the husbandry of wild animals (wildlife or

game farming), involving intensive care and management with the final goal of supplying animal products to the markets (Yerex 1982, Van Hoven and Ebedes 1994). Market-based wildlife farming was proposed as a legal substitute for wild-hunted animals because theory suggests that saturating the market with legal, high quality and affordable products should reduce the illegal collection of wild specimens and thus prevent extinctions (Layton 2001, Bulte and Damania 2005; Mitra 2005). Moreover, supply-side, market-based interventions can be more attractive and efficient (e.g. aquarium-fish sector; Wabnitz et al., 2003 or songbird keeping; Jepson and Ladle 2005) than traditional policy instruments such as hunting bans or the simple delineation of protected areas without sufficient law enforcement. Other examples include the captive breeding of fur animals such as artic fox (*Alopex lagopus*, IUCN Red List: LC), mink (*Neovison vison*; IUCN Red List: LC) and raccoon dog (*Nyctereutis procyonoides*, IUCN Red List: LC; Reid et al. 2016), which has been practiced for decades and is able to meet the consumer demand without jeopardizing the species' survival in the wild (Ashbrook, 1937, Ginsberg 1994). The shift from wild-caught to farmed animals was key to the recovery of these fur animals in the wild and farming has almost completely replaced wild resources (Ginsberg 1994). Given the control of relevant laws and regulations, the controlled and rational use of wild animals is not only beneficial to the protection of wildlife populations and their habitats, but also promotes the economic development of human societies (Rasker and Freese 1995, Sun and Wang 2007, Van Kooten and Bulte 2000). Social benefits of this approach are significant, playing an important role in promoting local people's employment, improving social stability and facilitating economic development (Bulte and Damania 2005). However, supply-side interventions may lack effectiveness due to consumer preferences for wild-collected products or low financial incentives for wildlife farming.

Ten years after the implementation of China's first Wildlife Protection Law (WPL) in March 1989, the Chinese government decided to develop China's wildlife industry and hosted the Wildlife Management Conference in 1999 (Pan et al. 2001, Zhang et al. 2001, Li et al. 2005). The conference advocated establishing large-scale breeding of wildlife, integrated processing and utilization of wildlife products. Other objectives included the advancement of the ecotourism industry, and coordinating development of conservation, captive breeding and sustainable utilization (Pan et al. 2001, Zhou et al. 2007, Meng 2008, Wang 2011). This initiative did not only conform to the essentials of China's tradition and socio-economic development, but also intended to increase support and awareness for the conservation of wildlife and associated habitats. Because of considerable efforts in wildlife conservation and declaration of several protected areas during the past 2 decades, great progress in preserving wildlife has been made in China (Harris 2008, Li et al. 2016). Although illegal hunting was greatly reduced, game farming and intensive game husbandry are still in a premature state with nontransparent and inchoate governmental legislation and vague guidelines for animal health and welfare (Li 2007, Harris 2008, Pickett and Harris 2015). To overcome these aberrations, China's government implemented a revised WPL in January 2017, the new primary document of legislation relating to the conservation of wildlife in China.

We want to join the discussion on China's supply-side approach to conservation and view it in the light of the newly introduced wildlife policies and legislations. We first highlight the importance of wildlife products in Chinese culture and economy, followed by an outline of the general benefits and drawbacks of China's supply-side approach to conservation. China's first WPL was an attempt to cease the ever-increasing take of wildlife from their natural habitats by legalizing the captive breeding of wildlife resources. However, a number of loopholes and shortcomings required that law to be revised. Subsequently, we compare

China's revised WPL to the previous version and discuss the relative merits and weaknesses of China's reviewed wildlife legislation.

Importance of Wildlife Products in Chinese Culture and Economy

Since time immemorial (>3,000 years,), captive breeding of wild animals and use of their products for food, clothing, or medicinal purposes have played an important role in Chinese culture (Still 2003, Chen 2006). Because if declining wild populations and poaching proved unprofitable, wildlife farming became increasingly popular and lucrative. Captive breeding populations were successfully established for >230 wildlife species (Cao 2014; for some commercially bred mammalian examples see Table 1). By the end of 2006, 19,018 wildlife breeding and farming ventures existed in China, including 3,166 commercial companies engaged in the processing and utilization of wildlife products (Meng 2008). Captive wildlife and alternative livestock industries in China have experienced unprecedented growth in recent decades (Lin 2004, Nijman 2010). For example, the Chinese fur industry is reported to grow by roughly 28% every year (2008-2010), with >70 million farmed foxes, minks, and raccoon dogs in 2010, compared to 55 million animals in 2009 (Petry and Liting 2010). These figures make China the largest fox and raccoon dog producer and the second largest mink pelts producer worldwide (Petry and Liting 2010). None of these species is currently listed as threatened by the IUCN red list (IUCN Red List 2015). Another example for China's growing wildlife industry is the sika deer (*Cervus nippon*; IUCN Red List 2015 status: LC), a species that was hunted in China for centuries to use their antler velvet in traditional medicine. Due to dwindling wild populations (<1,000 animals left in China; Harris 2015), sika deer farming has become a large scale industry with about 300,000 sika deer kept in captivity by the end of the 20th century (Ohtaishi and Sheng 1990). In 2004, 9,465 sika deer farms were reported, with 452,355 farmed sika deer, and an annual production of 73,000 kg

of deer antler velvet (Meng and Yin 2008). Due to the increased provision of antler velvet from captive stock, wild sika deer numbers are slowly recovering in China (Harris 2015). The most precious wildlife species farmed in captivity are musk deer (*Moschus* spp.; Sheng and Liu 2007). Similar to the fur and antler velvet industries, the Chinese musk production is increasing (Wang et al. 2015). Since the 1950s, musk deer are kept in captivity to harvest their musk, an oily substance secreted by a specific gland located between the genital and the naval of adult males (Parry-Jones and Wu 2001, Wang et al. 2015). For >5,000 years, musk was used for the production of traditional medicine but also as a scent fixative in cosmetics and perfumes (Holmes 1999). The annual average musk extraction per individual is only 12.26 g, while the Chinese demand is estimated to be around 2,000 kg per annum (Parry-Jones and Wu 2001, Cheng et al. 2002). Thus, musk is currently traded at around US$45,000 per kg making it more precious than gold (presently dealt at about US$38,000 per kg; Wang et al. 2015). These examples show how important wildlife products are in Chinese culture and highlight their significant economic value. The ever-increasing demand for wildlife products in conjunction with dwindling wild populations eventually prompted the Chinese government to implement and follow the supply-side approach to conservation by adopting the first WPL.

Benefits and Drawbacks to China's Supply-Side Approach

Although it might be viewed as a method of last resort, captive breeding of endangered wildlife species is considered to be an additional way to facilitate their conservation in China (Mitra 2005, Jiang et al. 2007). Beside other measures, such as the declaration of protected areas and serious law enforcement, wildlife farming can be an effective method to expand the number of wildlife populations that would otherwise face further population declines and possibly extinction (Zhou 1997, Wang 2002, Mitra 2005, Wang et al. 2010, Tensen 2016).

Market-based conservation strategies are not effective on their own, but seem to be best utilized as supplements to regulation and education (Zhong 2005, Sun and Wang 2007, Phelps et al. 2013). Above examples show that under certain circumstances the supply-side approach to conservation can be successful. These circumstances include that 1) farmed wildlife products should be considered equal in quality, taste, and status; 2) the demand for wildlife products can be satisfied by legalized products; 3) farming should be more cost-efficient than illegal hunt; 4) wildlife farmers should not depend on wild populations for restocking; and 5) laundering of illegal wildlife products into the commercial trade must be prevented (Tensen 2016).

In addition to reducing consumption of wild specimens and thus releasing pressure from natural populations (Mitra 2005, Jiang et al. 2007, Wang 2011, Tensen 2016), advantages of wildlife farming include: 1) protecting and managing wildlife species as a (genetic) reserve resource in captivity (Meng and Wang 1999, Che 2000, Sheng and Liu 2007); 2) providing legal and sustainable resources for utilization (Brown and Layton 2001, Bulte and Damania 2005); 3) providing resources and scientific data for medical and health research, teaching and science propagation (Pan et al. 2001, Sun and Wang 2007); and 4) promoting development of related industries such as the fur processing industry, the pharmaceutical industry, or tourism, and thus being an integral part of China's national economy (Fu 1993, Pan et al. 2001, Sun and Wang 2007, Cao 2014). However, there are also a number of drawbacks to the supply-side approach: by generating supplies from captive breeding stocks, wildlife commodity prices will fall, thereby lowering the incentive to hunt illegally. This will create an increased demand and raised incentives for poachers, simply because more people can afford the products, eventually leading to increased rather than decreased wild take (Fischer 2004). Moreover, supply-side approaches often ignore the institutional framework in which the wildlife trade takes place and potential strategic responses of traders and agents

(Damania and Bulte 2007). For example, the illegal trade of wildlife commodities is controlled by a small number of organized, criminal groups (Damania and Bulte 2007). These agents operate between poachers and consumers (or retailers), setting prices for poachers and determining the quantities to be released to the markets. Critical analysis including these aspects found that the effects of supply-side policies may contribute to further devastation of wild stocks instead of saving them (Damania and Bulte 2007, Tensen 2016). To counteract and avoid these drawbacks in the future, the Chinese government was prompted to review the previous WPL and implement a revised version.

China's Revised Wildlife Protection Law – Merits and Shortcomings

In March 1989, the People's Republic of China implemented the first WPL. After nearly 30 years of practice, setback, and experience, Chinese lawmakers made some progress in the field of wildlife legislation (Jiang 2003, Zhou and Zhang 2003, Chen 2006, Hua 2012). This progress is reflected by the new, revised WPL, which passed China's National People's Congress in July 2016 and took effect on 1st January 2017 (Zhang 2016). We will illustrate the improvements of the revised WPL and join the public discussion on China's wildlife protection by debating the relative merits and shortcomings of the revised WPL (Table 2). In recent decades, wildlife farming and use of wild animal products has become a sensitive and controversial issue, arousing public attention and arguments among the international conservation community (Parker and Graham 1971, Geist 1985, Milner-Gulland and Leader-Williams 1992, Kock 1995, Brown and Layton 2001, Wan 2004, Bulte and Damania 2005, Mitra 2005, Challander et al. 2015, Tensen 2016). In China, this became particularly true just before the newly enacted WPL took effect. National, but also international media coverage, and the public response were fairly critical of the revised law, although some comments highlighted the advantages of the new legislation (EIA 2016; Wang et al. 2016a, b; Zhang

2016; Diao 2017; Liu 2017; Gong et al. 2017).

The main concern regarding the revised WPL and its implementing regulations is a putative emphasis on wildlife utilization; that is, encouraging captive breeding and expanding opportunities to utilize wildlife, rather than protecting it (Xie 2016, Xu 2016, Yu 2016, Mang 2016, Ji 2016, Lei 2016, Li 2016). The law stimulates the demand for wildlife products rather than creating incentives to reduce it and consumers feel encouraged to use wildlife products although synthetic alternatives are often available (Diao 2016, Jiang 2016, Guo and Wei 2016, Ji 2016, Ma 2016). However, no matter whether the demand is met by the captive breeding or not, wild take will be reduced. Any proportion of the overall demand that can be covered by captive breeding reduces take from the wild of a similar proportion (Jori et al. 1995, Parry-Jones 2001, Lapointe et al. 2007, Biggs et al. 2013). For example, average annual bear bile production in China has reached 12,590 kg per annum, a supply that can almost meet the current market demand and thus reduce the wild take (Cao 2014). Similarly, the fur industry or the sika deer farming industry are able to meet consumer demands (Chen 2006, Meng and Yin 2008). According to the revised WPL, China's new approach to conservation follows 2 lines—protection and utilization—and is thus in line with policy documents published by the international conservation community (UNEP 1992, IUCN 2000, Abensperg-Traun 2009). The revised WPL highlights the priority of conservation over utilization (Article 4; Li 2016, Liu 2017) and is fairly balanced in weighing the 2 approaches against each other (Wang et al. 2016a, b). The law clarifies that utilization must be rational and sustainable, and announces strict measures of law enforcement (Articles 4, 29-35; Wang et al. 2016a, b). Apart from breeding programs for scientific research or conservation purposes, the phrasing avoids any terms that encourage or promote the domestication or the captive breeding of wildlife (Article 25). The Chinese government will also no longer award outstanding achievements in the domestication and breeding of wildlife as promoted by the

old WPL (Article 9 revised WPL *vs* Article 4 previous WPL). Furthermore, it was clarified that Chinese consumers can only use wildlife products that originate from captive populations and consumption or trade of specimens collected in the wild is clearly prohibited (Articles 29, 30; Wang et al. 2016a, b). The revised WPL is very specific in outlining wildlife species that are exempted from any use, compiling them in a detailed list of Chinese species under special state protection.

It was further claimed that the revised WPL opens the door for the laundering of poached wildlife by registered breeding institutions and may bring illegal goods to legal markets when trade is liberalized (Fischer 2004). Other critics raise concerns that the control of distribution links is not guaranteed, a marking permit system is not in place, and competency and jurisdiction are ill defined (Ma 2016, Xu 2016, Xie 2016). This will lead to competition between law enforcement authorities and more live-capture of wild specimens to satisfy the increasing demand of wildlife farms. To counter laundering, the Chinese government implemented a wildlife marking permit system (Articles 27, 28, 33), which is fundamental to China's wildlife protection and management legislation (Huang 2016). It ensures that the sources of wild specimens and products are legal (i.e., from licensed, registered captive breeding institutions) and thus sustainable and traceable. Granting of marks and labels is stringent: companies and breeding institutions must provide confirmatory materials (certificates of origin, purchase documents, breeding records, etc.), and rigorous reviews in conjunction with *in situ* evaluations determine whether marks will be awarded (Wang 2006, Huang 2016). Without a 'place-of-origin' label, wildlife and products thereof cannot be traded. Government authorities at various levels and their relevant departments will conduct the supervision and inspection of sale, purchase, utilization, transport, and mailing of wildlife and products thereof (Article 34). While the revised WPL clearly defines competency and

jurisdiction (Articles 42-56), the criminal law of the Peoples Republic of China provides the disciplinary measures. Marking and labeling of wild animals and their products is an internationally recognized and effective measure to control the use and trade of captive bred wildlife and its products (e.g., EU Council Regulation No. 338/97). Marking is highly valued by governments and nongovernmental organizations, and shown to be a useful tool for internal or cross-border trade control (Lin et al. 1999, Wang 2006, Huang 2016; but see also Zhang et al. 2008). Marking schemes were developed to prevent fraud, curtail illegal trade of specimens and products within the scope of the revised WPL, and ensure that traded specimens are in fact those referred to in the enclosed documents.

It was further argued that law-abiding consumers may operate in another market, separate from illegal consumers, and legal trade reduces the stigma of doing something unlawful. This will increase the overall demand, eventually augmenting the wildlife farmers' need to restock with wild specimens (Stiles 2004, Fischer 2004, Bulte and Damania 2005, Drury 2009, Abbott and van Kooten 2011). Because this phenomenon is based on consumer behavior and preferences, the WPL has only limited opportunities to influence it directly. Creating more conservation awareness through improved education, public outreach, and comprehensive media coverage is the only way to induce a change in consumer behavior (Article 8). Awareness creation must first tackle the overall demand for wildlife products and secondly—if demand persists—stigmatize consumption of illegally obtained specimens and encourage the consumption of legal products (Zhang and Yin 2014, Duan 2015). Only when captive-bred products dominate the market and demand does not increase, can wildlife farming be beneficial for conservation (Bulte and Damania 2005).

Another issue is the current situation of animal health and welfare conditions in Chinese

wildlife farms (Petry and Liting 2010, Pickett and Harris 2015, EIA 2016). Opponents assert that health and welfare stipulations are not included in the revised WPL and it completely ignores the increased risk of epidemics related to wildlife farming (Yu 2016, Diao 2016). Since the pandemic disease outbreaks of avian influence and SARS coronavirus in the early 2000s, the Chinese government focused great attention to the management of wildlife health and welfare in captive breeding institutions (Smith 2006, Arima et al. 2013). The revised law added a new article (Article 16) to prevent, identify and mitigate the risk of epidemics at the interface of wildlife, domestic livestock, and humans. The legislation also regulates how farm animals are raised, kept and transported in accordance with their natural habitats and behavioural properties (Article 26). Captive breeding of wildlife in China should be based on the ecological and behavioral requirements of each wildlife species to conform best to animal health and welfare standards (Wang et al. 2016a, b). This includes sufficient space, opportunities to retreat (from conspecifics and humans), enrichment structures, and suitable facilities to constrain animals for health treatment and breeding management (Hosey et al. 2013). At present, there are only 7 wildlife breeding institutions in China that were awarded the official certificate of the China Forest Certification Council (CFCC), indicating that their breeding and management conditions have achieved a satisfactory level of animal health and welfare standards (Zhong pers. comm.). One reason for the low level of legal registration and law abidance is the lack of governmental resources to efficiently control compliance (Zhao 2012). Currently, it seems impossible to strengthen the legal control of wildlife farming only by relying on government institutions and their financial and administrative resources. Article 5 of the revised WPL encourages private, nongovernmental institutions to support government bodies, enforcing the revised WPL, and supervise and control health and welfare conditions (Zhang 2016). It is thus suggested that wildlife management control and captive breeding licensing should be gradually replaced by third party certification and monitoring.

This will help government bodies to improve supervision efficiency and reduce public spending. It is further hoped that legally certified breeding institutions play a positive role within the industry and function as a role model for other wildlife farms in China and East Asia. Guidance for this supervision process could be the forest certification manual published by the Chinese State Forestry Administration (2014). This manual is an essential part of China's forest certification system, and defines the basic requirements for captive breeding of wildlife, including human resources (animal keepers, veterinarians), infrastructure (water, heating, etc.), dietary requirements and nutrition, reproduction, animal health and welfare, sanitation, animal euthanasia, and product acquisition. The licensing system, depicted by the forest certification manual, provides the requirements to verify whether wildlife-breeding units comply with relevant laws and principles of sustainability. The manual further aims to create awareness among wildlife farmers, guide them towards establishing sustainable management conditions, and follow animal health and welfare regulations. The legal award of captive breeding licenses and their strict control and enforcement are the only way for China to continue recognition by the international conservation community and realize the vision of a supply-side approach to conservation (Zhong et al. 2013).

Ultimately, the revised WPL was criticized for its narrow definition of wildlife: it should include all wildlife species, not only endangered species under special state protection such as tiger (*Panthera tigris*) and rhinoceros species (*Ceratotherium, Dicerorhinus, Diceros, Rhinoceros*), but also all other wildlife species that are not (yet) endangered or that have already recovered (Li 2016, Xu 2016, Xie 2016). Critics further suggest that the marking permit system for protected species should be also applied to nonprotected species (including invertebrates) that are kept in captivity. Wildlife species mentioned by the revised WPL are divided into 2 categories with different protection status: wildlife under first-class (special)

state protection and wildlife under second-class state protection (Article 10). In Article 2, it was further clarified that the law does not only apply to endangered species, but also to any other terrestrial species that has an important ecological, scientific, or social value (Wang et al. 2016a, b). However, the list appears incomplete, missing some Chinese species (e.g., the tufted deer [*Elaphodus cephalophus*]) and disregarding all non-native species (EIA 2016). The revised WPL makes a clear-cut differentiation between endangered species that are not permitted to be traded (i.e., all specimens from the wild) and those that are allowed to be traded as long as they are legally bred in licensed wildlife farms. Animals from the latter group must be recorded in the list of terrestrial wildlife for which artificial breeding technology was proven to be fully developed. Additionally, it should be mentioned that Article 12 clarifies to protect, restore, and improve the environments in which wildlife lives (i.e., the designation of protected areas and the preservation of natural habitats).

Of particular concern is also the regulation on disposal of seized items, which potentially allows for the auction of seized items derived from protected wildlife (EIA 2016). The revised WPL (Articles 6, 7, 9) and regulations for the management and disposal of seized terrestrial wildlife and wildlife products provide unambiguous guidelines on how to handle seized items. Moreover, 2 new articles (Articles 56, 57) were added to the revised WPL clarifying the management, storage, or disposal of seized items. As a professional standard method, all seized items must be evaluated and quarantined before handed over to local wildlife departments for destruction or the exhibition in educational institutions such as schools and museums. Seized wildlife or wildlife products from foreign countries must be returned to the exporting country, stored at secured and authorized locations, or destroyed. Generally, any seized item is prohibited from being auctioned.

Given the above arguments, it is essential to guide the international (and Chinese) public to openly discuss both—negative and positive—aspects of the revised WPL and establish the right balance between wildlife conservation and utilization. Facing current levels of public concern and the international attitude towards wildlife utilization in China, we must establish a proportionate and fair discussion, and strengthen our professional guidance by building our decisions on sound scientific evidence when implementing the concept of wildlife conservation through utilization. Some nongovernmental organizations propagated only one-sided coverage and developed network media platforms where lopsided opinions are reiterated. However, such media-coverage inspires the enthusiasm of the public to preserve wildlife (and its habitats), promote the implementation of 'absolute protection' and propagate the relinquishment of consuming wildlife products (Lu and Zhang 2012).

Conclusions and Recommendations

Despite CITES, other international regulations and worldwide anti-poaching efforts, the illegal trade in many endangered species has increased in recent years (Rosen and Smith 2010, Drury 2011, Challender and MacMillan 2014). It seems that current interventions and regulations, including actual law enforcement actions, are not sufficient to prevent poaching (Abbott and van Kooten 2010, Rosen and Smith 2010, Wellsmith 2011, Tensen 2016). To avert further extinctions due to illegal hunting, alternative approaches must be considered. The concept of 'conservation through utilization' is such an alternative approach, but is at the same time a disputed one in wildlife conservation (Mitra 2005, Jiang et al. 2007; Tense 2016). Criticism on rational wildlife utilization has continuously increased during the last 26 years (coinciding with the period the previous WPL was in place), leading to a reduction of wild animal consumption and a gradual shift towards legal substitutes. No doubt, the excessive, unsustainable use of wildlife resources from the wild should be strictly prohibited,

but species for which captive breeding technology as well as health and welfare standards are established should be used by humans (Kock 1995).

We strongly propose captive breeding as being the only feasible approach to China's wildlife conservation/utilization dilemma. Moreover, we want to counteract the negative international attitude towards China's attempts to rationalize the utilization of wildlife, following successful examples from Africa and other parts of the world (see review by Hudson et al. 2010). The revision of the old WPL represents an important effort in strengthening wildlife conservation, regulating wildlife utilization and promoting harmonious development of humans and nature in China. Despite these advances, the revised WPL still needs to address animal welfare aspects, effective law enforcement, and border controls (Li 2007, Nijman 2010, Pickett and Harris 2015). Furthermore, it would be desirable if the new WPL would advocate for more conservation awareness through improved education, public outreach, and comprehensive media coverage (Duan 2015). A constructive and progressive discussion to improve China's national standards for captive wildlife breeding (wildlife farming) is needed to further develop conservation legislation. Advancing this appeal, we forward the following suggestions:

(1) The duties, functions, and authority of the permit-issuing and law-enforcing administrations must be clarified. Currently, the management and administration of some species, especially of non-national key or alien species remains indistinct.

(2) It is imperative to strengthen the law enforcement, emphasize the illegality of harvesting wild animals in their natural habitat, and further match phrasing with international legislations.

(3) The government of China ought to increase funding for the conservation of wild animals (i.e., improve and increase *in-situ* conservation), promote scientific research on game farming species, establish a rational, independent monitoring system, and increase public awareness.

(4) China's wildlife legislation should promote third-party certification and monitoring by nongovernmental organizations. The law should include the opportunity for regulations that supplement government legislation (e.g., nongovernmental organizations and industry develop own health and welfare standards and monitor themselves through third-party guided self-control).

(5) The revised law should pay more attention to health and welfare standards for wildlife in captivity, including prevention of epidemics, vaccination schemes, transport, enclosure enrichment, sedation, confinement, handling, and capture.

(6) China's wildlife legislation needs to ensure the correct disposal of seized items (i.e., the relentless destruction of seized items derived from protected wildlife species, except for scientific or educational purpose).

ACKNOWLEDGMENTS

The authors would like to thank two reviewers and the editorial team of the Wildlife Society Bulletin for their considerable input to advance the publication of this article. Furthermore, we are greatly indebted to Jennifer Gervais (Associate Editor) for improving and commenting on previous versions of our manuscript. The research was funded by Science and Technology Development Center of the National Forestry and Grassland Administration (The special researches on certification of precious and endangered wildlife for production and management, RZ 2017-3, RZ 2019).

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Table 1

Most common, commercially bred mammalian species in China, the estimated total number in captivity, and the breeding purposes. (*) endangered species under special state protection, (#) commercial use prohibited.

Common name	Scientific name	Estimate number	Reference	Breeding purpose
Musk deer	*Moschus berezovskii*, *Moschus moschiferus*, *Moschus sifanicus*	8,400	Li (2012)	musk (base note in perfumery)
Sika deer	*Cervus nippon*	1,200,000	Yang (2012)	antler velvet (cartilage and tendon injuries), venison
Wapiti deer	*Cervus canadensis*	80,000	Yang (2012)	antler velvet and venison
Saiga*	*Saiga tatarica*	51	Li, Zhao & Bennett (2007)	horn (reducing body heat, detoxification, releasing infant fevers & epilepsy)
Rhinoceroses*, #	*Rhinoceros, Ceratotherium, Diceros*	several 100	Graham-Rowe (2011)	horn (fever, rheumatism, gout)
Macaque	*Macaca mulatta*	8,000	Kong (2008)	laboratory experiments
Asian black bear	*Ursus thibetanus*	9,905	Cao (2014)	bear bile (treatment of inflammation, bacterial infections, gallstones, pain)
Brown bear	*Ursus arctos*			
Sun bear	*Helarctos malayanus*			
Tiger*, #	*Panthera tigris*	4-5,000 6-10,000	Abbott & van Kooten (2011) Graham-Rowe (2011)	bone (hemiplegia joint sprains), urine (rheumatism)
Mink	*Neovison vison*	70,000,000	Petry & Liting (2010)	fur, clothing
Artic fox	*Vulpes* (*Alopex*) *lagopus*			
Raccoon dog	*Nyctereutes procyonoides*			

Table 2

Legal and administrative improvements by China's revised WPL.

	Previous WPL	**Revised WPL**
1	'Priority of conservation', 'rational and sustainable utilization' and 'strict law enforcement' were not explicitly highlighted.	The principles of 'priority of conservation', 'rational and sustainable utilization' and 'strict law enforcement'were manifested.
2	The scope of wildlife conservation was limited.	The new law does not only apply to endangered species, but also to any other terrestrial species that has an important ecological, scientific or social value
3	No specific provisions about the origin of commercial wildlife product.	Chinese consumers can only use wildlife products that originate from captive populations and the consumption or trade of specimens collected in the wild is clearly prohibited
4	No provisions for a marking scheme were included.	Marking schemes were developed to prevent fraud, to curtail illegal trade of specimens and products, and to ensure that traded specimens are in fact the ones referred to in the enclosed documents.
5	Legal prosecution and penalization were lacking vigour. No legal liability for violating nature reserve regulations or destroying wildlife habitat.	The intensity of legal prosecution and penalization was increased, e.g., by the provision to confiscate illegal wildlife products, hunting implements and all unlawful income, by suspending special hunting licenses, and by fining perpetrators one to five times the value of the commodity. The new WPL also includes legal liability for violating nature reserve regulations or destroying wildlife habitat. Moreover, wildlife conservation authorities and their relevant departments will be held responsible for any dereliction of duty.
6	Ignored the importance of habitat protection.	The provision forwildlife habitat protection was included.
7	Legal procedures for hunting, artificial breeding, utilization, and tradewere either very vague or were not included.	Legal procedures for hunting, artificial breeding, utilization, and trade were refined and specified.
8	Protection and management measures for captive and wild populations were either missing or vaguely formulated.	In addition to the provisions of the previous WPL, newly tailored protection and management measures for captive and wild populations were implemented. In recent years, wildlife breeding techniques have experienced major breakthroughs, forming larger, healthier and more stable captive populations, to a degree that artificial breeding populations can meet the

		market demand. These experiences were included into the revised WBL.
9	Compensation for wildlife damage and insurance by the central government were not stipulated.	Existing provisions for wildlife damage compensation and insurance by the central government were supplemented by requesting local governments of provinces, autonomous regions and municipalities toformulate and implement directives for the compensation of injury, death, crop raiding or other losses of property.Local government bodies were urged to provide own subsidies for compensation, and to encourage insurance companies to develop and set-up insurance programs to compensate for damage caused by wildlife.
10	Guidelines for wildlife reintroduction and release procedures were not enclosed.	Guidelines for wildlife reintroduction and release procedures were added, largely following IUCN reintroduction and translocation guidelines (IUCN 2013).
11	Although a licensing system for wildlife farms and the trade with captive bred wildlife specieswas in place, regulations regarding breeding conditionsand animal welfare were insufficient,and without specific standards and regulatory measures.	A certification scheme for wildlife breeding and trade was implemented and regulations regarding breeding conditionsand animal welfare with specific standards and regulatory measures were established.
12	The disposal of seized items was vague and not specific.	The new law added specific regulation about the disposal and management of seized items.