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REVIEW

A review of the ecological and socioeconomic characteristics of trophy hunting across Asia

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Keywords
Asia; conservation spending; communities; other effective area-based conservation measures (OECM); revenue sharing; trophy hunting; socioeconomics.

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Abstract

The continuing debates about trophy hunting should be underpinned by an understanding of at least the basic characteristics of the practice (e.g. species, quotas, areas, prices). Whilst many countries in Asia have established trophy hunting programmes of considerable importance to conservation and local livelihoods, there remains some ambiguity over the extent of trophy hunting in Asia as its basic characteristics in each country have not been compiled. In this study, we compile information on various ecological and socioeconomic characteristics of trophy hunting of mammals for countries across Asia by reviewing published and unpublished literature, analysing trade data, and obtaining contributions from in-country contacts. Across Asia, established trophy hunting programmes exist in at least 11 countries and target at least 30 species and one hybrid (incl., five Vulnerable and one Endangered species). Trophy hunting in these countries varies markedly in areas (e.g. >1 million km^2 in Kazakhstan, 37% of country, vs. 1325 km^2 in Nepal, <1% of country) and annual offtakes (e.g. Kazakhstan: 4500 individuals from 4 of 5 trophy species; Pakistan: 229 from 4 of 7; Mongolia: 155 from 6 of 9; Tajikistan: 126 from 3 of 6; Nepal: 22 from 3 of the 4 that are trophy hunted in practice). Permit prices also vary across species and countries, with domestic and international hunters sometimes charged different rates. Hunters from the USA appear overwhelmingly prominent among international clients. National legislations typically mandate a proportion of trophy hunting revenue to accrue locally (range: 40–100%). We provide five key recommendations for research to inform trophy hunting policy in Asia: (1) Ecological impact assessments; (2) Socioeconomic impact assessments; (3) Evaluations of the contributions of trophy hunting to conservation spending; (4) Evaluations of the contributions of trophy hunting to the post-2020 Global Biodiversity Framework; (5) Further examinations of perceptions of trophy hunting.

Introduction

Trophy hunting is controversial and challenging to implement, which can lead to divergent views and fierce debates over its appropriateness and effectiveness (Houdt *et al.*, 2021). For example, Horowitz (2019) appealed to stop trophy hunting in Africa, whereas Dickman *et al.* (2019) outlined the risks of trophy hunting bans for conservation. Trophy hunting is a form of sport hunting in which wild animals are valued as trophies. Parts of the hunted animal (often exceptional physical attributes such as large horns) are kept and displayed by the hunter to honour the animal and

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remember the hunting experience (Johnson *et al.*, 2010). Normally, annual quotas are set by governing bodies, hunts are marketed by outfitters (IUCN, 2016), and the hunting itself is conducted in designated areas run by private entities, government bodies or community organisations (Baldus, Damm, & Wollscheid, 2008; IUCN, 2016).

In certain cases, and across multiple continents, trophy hunting is thought to contribute towards conservation by incentivising species and habitat protection, as well as to generate valuable revenue for local communities and at national levels (Baldus *et al.*, 2008). Committing to certain principles can promote the sustainability of trophy hunting; for instance, adhering to suitably low, evidence-based offtakes and restricting hunting to mature, non-breeding individuals (Nelson, Lindsey, & Balme, 2013; Di Minin, Leader-Williams, & Bradshaw, 2016). Sustainable trophy hunting may be a particularly important conservation tool where ecotourism is not feasible, such as remote areas with low wildlife densities, as trophy hunting often generates more revenue per client and hunters are more tolerant of harsh conditions (Booth, 2002; Leader-Williams & Hutton, 2005). Moreover, the adequate distribution of benefits from trophy hunting can bolster local support for conservation (Nelson *et al.*, 2013; Angula *et al.*, 2018).

Trophy hunting, however, can also have deleterious impacts. Valid criticisms of certain hunting programmes can be ecological, social and ethical. Ecological problems can include driving population declines and disrupting age-sex and social structures (Loveridge *et al.*, 2007; Packer *et al.*, 2010), while social problems may involve the inadequate or inequitable distribution of benefits which often stem from poor trophy hunting governance (Nelson *et al.*, 2013). More fundamental concerns about trophy hunting relate to animal welfare and the ethics of the practice, which arguably constitute the main obstacles to trophy hunting as an acceptable conservation tool (Batavia *et al.*, 2018).

The trophy hunting industry has received a wealth of attention in both public and academic spheres – especially trophy hunting in areas of sub-Saharan Africa (Lindsey, Roulet, & Romanach, 2007). Yet, in comparison to other areas, trophy hunting in Asia has received relatively little attention in the public and academic spheres. This is despite the fact that trophy hunting in Asia involves a diverse array of species, mainly ungulates like markhor *Capra falconeri*, Siberian ibex *Capra sibirica*, argali *Ovis ammon*, chamois *Rupicapra rupicapra*, and mouflon *Ovis gmelini*, as well as carnivores like grey wolf *Canis lupus* and brown bear *Ursus arctos*, and that, in some areas, it yields valuable benefits for local communities (Ali *et al.*, 2015; Aryal *et al.*, 2015; Karimov & Cooney, 2019; Rashid *et al.*, 2020). Many trophy hunting areas in Asia also harbour conservation-priority wildlife, such as snow leopard *Panthera uncia* and Persian leopard *Panthera pardus tulliana* (Nawaz *et al.*, 2016; Farhadinia *et al.*, 2018; Hosseini *et al.*, 2019), meaning that the impacts of trophy hunting could have cascading effects on the conservation of such co-occurring species (Farhadinia, Moqanaki, & Hosseini-Zavarei, 2014). Moreover, recently established trophy hunting programmes in Japan and the United Arab Emirates indicate that, from a certain perspective, the practice is spreading in Asia (Igota & Suzuki, 2008; Barari Hunting, 2021). However, comprehensive information on the characteristics of trophy hunting across the continent is currently lacking.

Therefore, our main goal of this paper is to consolidate and outline the key ecological and socioeconomic characteristics of trophy hunting in Asia. First, we outline the areas, species, and countries involved in the trophy hunting. We then consider socioeconomic characteristics of the trophy hunting by outlining tender permit prices, mandated revenue sharing, and client origin. Based on these findings, we recommend future directions for research and action on the ecological and socioeconomic impacts of trophy hunting in some of the Asian countries. Although still hampered by a lack of robust information and ambiguity, this paper is the most comprehensive compilation of existing information on trophy hunting for Asia.

Materials and methods

We first surveyed trophy hunting outfitter websites to determine a conservative list of taxonomic and geographic scope of our study (Supporting Information Table S1). Although trophy hunting was advertised in Georgia, Japan, and the United Arab Emirates, we omitted these countries as their hunting industries appeared relatively minor. We then compiled our database of trophy hunting characteristics using three sources of data: existing literature, in-country contacts, and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) trade database (https://trade.cites.org/en/cites_trade) (Supporting Information Table S2).

Literature review

We obtained information on trophy hunting of mammals in Asia by reviewing published and unpublished literature that satisfied the following inclusion criteria. First, the topic of the literature related directly to trophy hunting of mammals, in that it contained details on certain aspects of trophy hunting (Supporting Information Table S2) or evaluated its impacts at any scale in Asia. Literature could have any publication date and report figures from any time period, yet only the most recent figures are reported in this paper. Finally, as far as could be determined, any figures presented were reliable – for instance, figures directly or indirectly from an official government body or those presented in peer-reviewed journal articles. Google Scholar search engine was used to identify relevant scholarly literature. Our boolean search criteria included the following keywords: ("trophy hunting" OR "sport hunting" OR "recreational hunting") AND ("Asia" OR "Azerbaijan" OR "Iran" OR "Turkey" OR "Kazakhstan" OR "Kyrgyzstan" OR "Tajikistan" OR "Uzbekistan" OR "Nepal" OR "Pakistan" OR "Mongolia" OR "Russia").

This search returned 7302 pieces of literature. Based on an assessment of titles against our inclusion criteria of

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relevance, timeframe, and reliability, we reduced this literature set to 198 documents. Whole documents were then considered against our inclusion criteria and 73 were kept. From this literature we compiled information on country-level ecological (e.g. annual offtakes, total area), socioeconomic (e.g. permit prices at tender, revenue sharing) and governance (e.g. land ownerships status) aspects of trophy hunting. We reported the most recent figures obtained. Permit price at tender is the amount paid by hunters or hunting outfits to a respective governing body to secure the opportunity to hunt an animal. This first transaction for securing the permit to hunt can be followed by various steps leading to the actual hunting such as direct hunting by the hunter obtaining the permit or auction of the permit by a hunting outfits to the highest bidder wanting to hunt. We focus on this component because it usually constitutes a relatively large proportion of revenue that is directly attributable to trophy hunting and can be broadly compared across species and countries. Nevertheless, we acknowledge that trophy hunting can also generate revenue via other avenues, like through fees to access hunting grounds, hire guides, and secure accommodation These other benefits maybe substantial for the local communities and need accounting for in future investigations. For prices reported in a local currency, we used the historical exchange rate for January of the given year (as reported by the International Monetary Fund; https://www.imf.org/external/np/fin/data/param_rms_mth.aspx) to calculate a USD value. In addition, to contextualise our information on revenue sharing from trophy hunting, trophy hunting revenue is usually considered to be the revenue generated from the sale of hunting permits at tender. This transaction may be between government bodies and hunting clients directly, or between government bodies and hunting outfitters who in turn sell the permits to clients.

Other sources of information

We supplemented the information gathered from existing literature by contacting in-country academics and practitioners who, in some cases, were able to provide recent figures. We approached six expert in-country contacts (authors 3–6) and requested information on specified aspects of trophy hunting in the given country (Table 1). Where possible, this information was used to supplement figures taken from the compiled literature.

Data collection from the CITES database on trophy trade from Asia for 2010–2019 broadly followed the approach of Mallon (2013). We therefore only extracted trade records for bodies, skulls, skins, or trophies (collectively referred to as trophy items). Restricting the extract to these products prevented exaggerated estimates of actual trophy trade as these are the primary trophy items. This is substantiated by the fact that each trophy (e.g. skin or horns) from the range of animals trophy hunted in Asia is obtained from an individual. In addition, only shipments with purpose code *Hunting Trophy* or *Personal* were included. An exception to these criteria was made for trophies, for which *Commercial* shipments were also included. The purpose code *Hunting Trophy* refers to trade in whole animals or derivates that were legally obtained by the hunter via hunting for the hunter's personal use and are being transported by or on behalf of the hunter as part of the transfer from its country of origin, ultimately to the hunter's state of residence. Purpose code *Personal* presumably refers to specimens transported for personal or non-commercial reasons, whilst *Commercial* relates to trade for the purpose of obtaining economic benefit (whether cash or otherwise). This process yielded a trade database of trade in Asian trophies, each with source country, destination country, and number of items. From this database, we calculated the average annual quantity of trophy items exported from Asian countries with major trophy hunting industries for each CITES-listed trophy species (2010–2019). We also calculated the number of trophy items imported into the main destination countries for each CITES-listed trophy species (2010–2019).

Results

A total of 76 trophy hunting outfitter websites involved in trophy hunting across Asia were surveyed. We identified 11 Asian countries to have an established trophy hunting industry (Figure 1). Our literature search and refinement process yielded a total of 73 pieces of published and unpublished literature related to trophy hunting in Asia between 1998 and 2020. Most figures obtained from the literature are relatively recent; for instance, 74% and 93% of the offtake and permit price figures, respectively, belong to post-2010 period. Information on trophy hunting from our six expert in-country contacts was more recent (post-2017). We also gathered 2123 shipment reports from the CITES database for the period between 2010–2019, which comprises of 9972 presumed trophy items.

Trophy hunting areas

Trophy hunting can be carried out across vast areas of some countries in Asia; for example, around 1 008 213 km^2 of Kazakhstan (37% of the country; Michel *et al*., 2015), 332 846 km^2 of Turkey (43% of country; H. Ambarlı, 2021; pers. comm.), 139 930 km^2 of Kyrgyzstan (70% of country; Nordbø, Turdumambetov, & Gulcan, 2017), and at least 35 534 km^2 of Pakistan (4% of country; Muhammad Kabir, 2021; pers. comm.). In contrast, trophy hunting is only permitted in 1325 km^2 area of Nepal (G. Khanal, 2021, personal communication). We were unable to identify the total areas for trophy hunting in other countries. There are five main types of areas in which trophy hunting is carried out through established programmes in Asia: (1) State-managed protected areas; (2) Community-managed hunting concessions; (3) Privately managed hunting areas; (4) Areas of mixed governance (i.e. a combination of state, community, and private); and (5) Free areas without any specific type of management.

Target species

At least 30 species (plus red sheep, a hybrid between mouflon and urial) of mammal from 8 families are regularly

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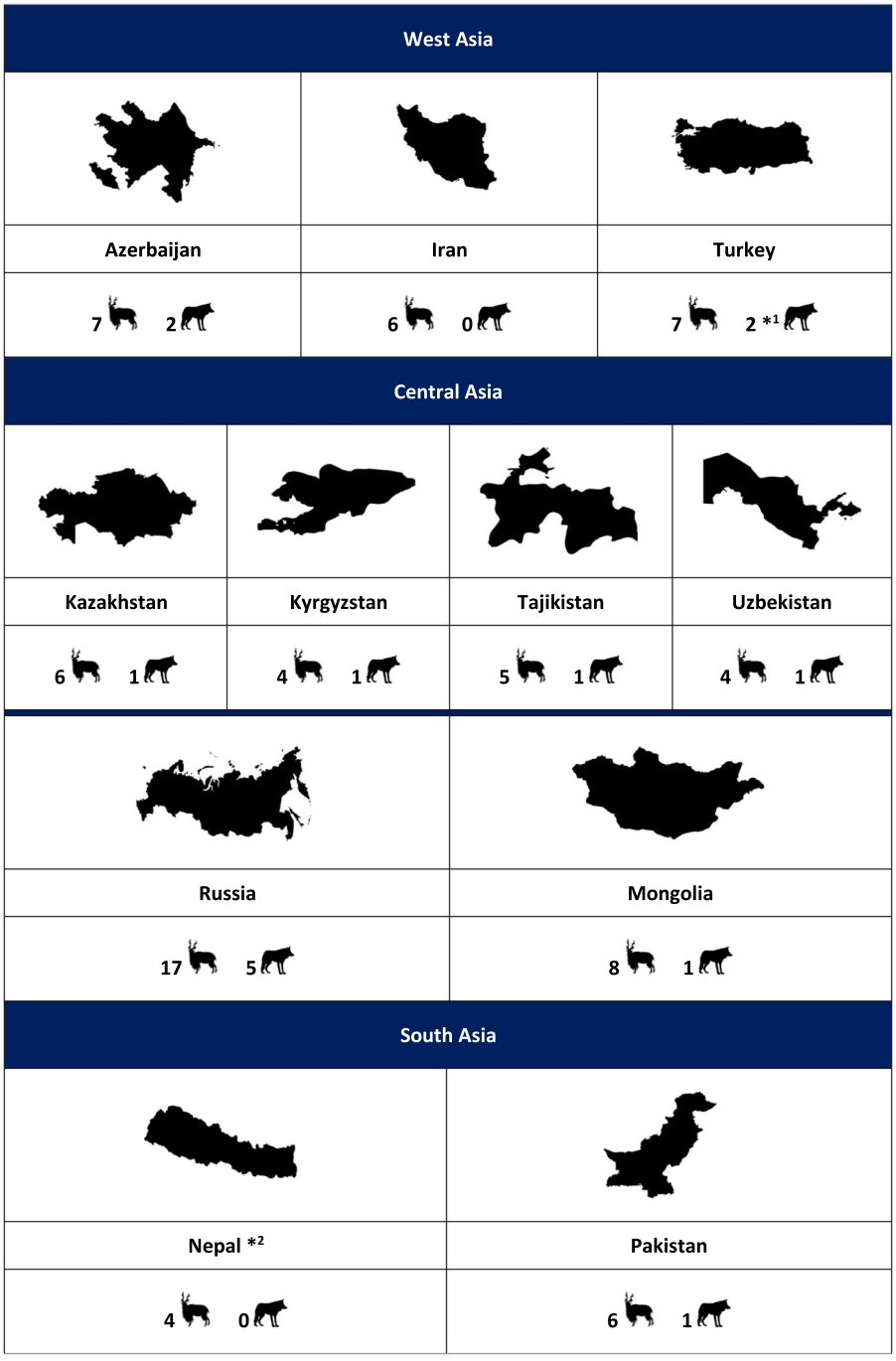


Figure 1 The 11 countries in Asia with established trophy hunting programmes included in this study. Markhor and wolf silhouettes denote number of herbivore and carnivore species targeted by trophy hunting programmes in each country, respectively. Further details are provided in Table 2. *[1]Note that brown bear hunting was open in 2015 and 2016 in Turkey and, whilst brown bear and grey wolf are protected under Turkey's national law and the EU Habitat directives, Turkey has an exception for damage causing bears and wolves and can intermittently declare quotas to hunt them. *[2]Note that as many as 10 species are legally allowed for hunting in Nepal, but in practice only a few species are actually trophy hunted.

targeted for trophy hunting in Asia (Table 1). This consists of 25 species of herbivores (plus the red sheep) and 5 species of carnivore (including brown bear and Asiatic black bear). Fifty-seven percent of the species (n = 17) are listed as Least Concern on the IUCN Red List and 23% are listed as Near Threatened (n = 7). Twenty percent of the species

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Table 1 Annual offtakes via trophy hunting by domestic and international hunters in Asian countries with major trophy hunting programmes (years for figures vary by species and country)

				West Asia			Central Asia				South Asia		Central Asia	
Family	Species		IUCN Red List category	Azerbaijan	Iran	Turkey	Kazakhstan	Kyrgyzstan	Tajikistan	Uzbekistan	Nepal	Pakistan	Mongolia	Russia
Bovidae	Bezoar goat	*Capra aegagrus*	Near threatened		WS: 144[1]	312[13,a]						YES		YES
	West Caucasian Tur	*Capra caucasica*	Endangered											YES
	Dagestan Tur	*Capra cylindricornis*	Near threatened	YES										YES
	Markhor	*Capra falconeri*	Near threatened						15[12]	YES		12[10]		
	Siberian Ibex	*Capra sibirica*	Near threatened	YES			900[2]	650[5,a]	60[17]	YES		150[9]	60[7]	YES
	Goitered Gazelle	*Gazella subgutturosa*	Vulnerable		22[1]	6[13]							YES	
	Himalayan Tahr	*Hemitragus jemlahicus*	Near threatened								7[8]			
	Argali	*Ovis ammon*	Near threatened					80[3,a]	51[11]	4[15]			40[6]	YES
	Mouflon	*Ovis gmelini*	Near threatened		WS: 144[1]	5[13]						YES		
	Red Sheep	*Ovis gmelini x Ovis vignei*	Not applicable		WS: 144[1]									
	Snow Sheep	*Ovis nivicola*	Least concern											YES
	Urial	*Ovis vignei*	Vulnerable		WS: 144[1]				YES			49[10]		
	Mongolian Gazelle	*Procapra gutturosa*	Least concern										YES	YES
	Blue Sheep	*Pseudois nayaur*	Least concern								13[8]	18[9]		
	Chamois	*Rupicapra rupicapra*	Least concern (however, the Anatolian chamois, *Rupicapra rupicapra asiatica*, sub-species is Endangered[19])	YES		23[13]								YES
Canidae	Grey Wolf	*Canis lupus*	Least concern	YES		YES[18]	YES	YES[4]	YES	YES			20[7]	7074[4,a]
Cervidae	Moose	*Alces alces*	Least concern											YES
	European Roe Deer	*Capreolus capreolus*	Least concern			99[13]	YES						YES	YES
	Siberian Roe Deer	*Capreolus pygargus*	Least concern	YES			2021[2]	YES					10[7]	YES
	Elk	*Cervus canadensis*	Least concern				YES							YES
	Red Deer	*Cervus elaphus*	Least concern	YES		47[13]	498[2]						15[6]	YES
	Sika Deer	*Cervus nippon*	Least concern	YES										YES
	Indian Muntjac	*Muntiacus muntjak*	Least concern								1[8]			
	Whitetail Deer	*Odocoileus virginianus*	Least concern											YES
	Reindeer	*Rangifer tarandus*	Vulnerable											YES

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Table 1 Continued

Family	Species		IUCN Red List category	West Asia			Central Asia				South Asia		Central Asia	
				Azerbaijan	Iran	Turkey	Kazakhstan	Kyrgyzstan	Tajikistan	Uzbekistan	Nepal	Pakistan	Mongolia	Russia
Felidae	Eurasian Lynx	*Lynx lynx*	Least concern											340[16,a]
Moschidae	Siberian Musk Deer	*Moschus moschiferus*	Vulnerable											4235[16,a]
Mustelidae	Wolverine	*Gulo gulo*	Least concern											YES
Suidae	Wild Boar	*Sus scrofa*	Least concern	YES	YES	20[14]	1162[2]	YES	YES	YES	<1[8]		10[6]	YES
Ursidae	Brown Bear	*Ursus arctos*	Least concern	YES		YES[18]						YES		4215[16,a]
	Asiatic Black Bear	*Ursus thibetanus*	Vulnerable											YES
Annual total of identified quotas (relevant year(s) for total)				Unable to calculate	217 (2019)	492[a] (2008–2009 and 2018–2019)	4581 (1998)	730[a] (2014 and 2014–2015)	126 (2010–2011, 2012–2013 and 2018–2019)	6 (2004–2005)	22 (2016–2021)	229 (2017–2018 and 2020)	155 (2015)	15 864[a] (2008–2009 and 2009–2010)

References and relevant year(s) of figures: 1. Iran National Environment Fund figures for 2019–2020 that refer to all wild sheep; 2. Baldus (2014) for 1998; 3. Nawaz *et al.* (2016), assumed for 2014–2015; 4. Mallon (2013) for 2008–2009; 5. Michel *et al.* (2015) for 2014; 6. WWF (2015) for 2015; 7. Page (2015) for 2015; 8. Data received from DNPWC for 2016–2021 annual average; 9. Kamran (2020) for 2020; 10. Saif (2017) for 2017–2018; 11. Rosen (2012) for 2010–2011; 12. CITES (2019) for 2018–2019; 13. Yayla, Yayla, & Aktas (2020) for 2018–2019 but amended according to input from H. Ambarlı; 14. Baskaya, Baskaya, and Arpacik (2012) for 2008–2009; 15. Mallon (2013) for 2004–2005; 16. Mallon (2013) for 2009–2010; 17. Mallon (2013) for 2012–2013; 18. Note that brown bear hunting was open in 2015 and 2016 in Turkey and, whilst brown bear and grey wolf are protected under Turkey's national law and the EU Habitat directives, Turkey has an exception for damage causing bears and wolves and can intermittently declare quotas to hunt them (H. Ambarlı, 2021; pers. comm.); 19. Anderwald *et al.*, 2020. 'YES', denotes that our review indicates that the species is trophy hunted in that country but a recent estimate for annual offtake via trophy hunting could not be obtained.

[a] A figure that relates to annual offtake of a trophy species, but not necessarily via trophy hunting alone (may also include culling, big-game hunting, and offtakes for scientific purposes).

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were listed under a threatened category of the IUCN Red List; specifically, 5 Vulnerable species and 1 Endangered species (West Caucasian tur, *Capra caucasica*). In addition, the Anatolian chamois *Rupicapra rupicapra asiatica*, a subspecies, is classified as Endangered. Wild boar was hunted in almost all countries (n = 10), followed by grey wolf (n = 8 countries), and Siberian ibex (n = 8 countries). At subspecific level, outfitters explicitly advertised multiple subspecies of a species, mainly for argali (12 subspecies), brown bear (7 subspecies), and snow sheep (6 subspecies). The highest number of trophy species was recorded for Russia (22), followed by Mongolia and Azerbaijan (both 9).

Governance of trophy hunting areas

Areas where trophy hunting is conducted have varying forms of governance structures. There are forms of collaborative governance to frame the structure of community-based trophy hunting (CBTH) as a form of collaborative governance that involves multiple stakeholders in the management of common pool resources (e.g. the Torghar project in Pakistan, Woodford, Frisina, & Awan, 2004). Pakistan's community-based trophy hunting program (CTHP) is premised on providing financial incentives to local communities as a means to acknowledge their contribution to the protection of wildlife in their designated Community Conservation Areas (CCA). Most of these people in these regions are poor, marginal and disadvantaged. Their livelihoods are predominantly dependent on locally available natural resources (Kifayat, Khan, & Ejaz, 2014). As a means to protect wild animals, particularly charismatic mountain ungulates and their mountain habitats, local communities along with provincial wildlife authorities, create CCA, under CTHP. It is crucial for the CTHP's to have well-defined boundaries, robust governance structures, and approved management plans. The CCA's management plan needs to be first approved by local governance structures, which is followed by a notification by the government in the official gazette, which empowers the local people in the management process (Zaman *et al*., 2019). Majority (upto 80%) of the trophy hunting fee goes directly to the local communities (Nawaz *et al*., 2016) and is handed over to the CCA by the government within a 45 day period. Trophy revenue earned by communities is used for collective social, economic, and environmental development activities. These include but are not limited to repairing irrigation channels for agriculture, building community schools and basic health units, providing educational stipends and scholarships, provisioning of loans to women for micro businesses, and improving farm-to-market connectivity through village link roads. Socio-economic development activities (projects) are identified by the respective Village/Valley Conservation Committee (VCC) in consultation with VCC member households, agreed in resolution, and implemented as community projects. Based on this, CTHP has become a significant source of revenue (>30%) for conservation and management of wildlife populations and their habitats in the rugged, remote regions of Pakistan (Shackleton, 2001). Nevertheless, there are certain critical problems related to such trophy hunting programmes, including limited accurate information illustrating effects of trophy hunting on herd structure and size, weak policy implementation, lack of transparency and corruption (Adhikari *et al*., 2021).

On the other hand, in most of the Central Asian countries where trophy hunting occurs (e.g. Tajikistan, Kyrgyzstan and Kazakhstan), wildlife is the property of the state which awards rights to use it to individuals or other entities. For instance, in Kyrgyzstan, all hunting areas belong to the government, and, according to Article 11 of the Law of the Kyrgyz Republic which is based on hunting and hunting economy, the right to hunt is given to legal entities (i.e. companies) usually for a period of 15 years (Nordbø *et al*., 2017). Hunting areas cover nearly 70% of Kyrgyzstan and the trophy hunting tour operators, who are generally based in the capital Bishkek, organise travel to various parts of the country. The Kyrgyz government also provides hunting permits to Kyrgyz citizens. The perception in Kyrgyzstan is that revenue from trophy hunting is part of the shadow economy, majority profits are gained by the tour operators and a few local or regional officials related to these companies. A similar model is operated in Kazakhstan, where wildlife exploitation and management is under the purview of the *Okhotzooprom* (state hunting department), with limited involvement of local people in protection, management and utilisation of hunted species and state-based approaches are preferred (Michel *et al*., 2015). Similarly in Russia, in accordance with Federal Law of 29.12.2006 No. 258, implementation of federal State hunting control and supervision were delegated to regional and similar administrative units of Russia. The Ministry of Natural Resources (which as a hunting department as the executive wing) has overall responsibility for development and promotion of State policy in the field of hunting and conservation of hunting resources, including regulations and subordinate acts (Mallon, 2013). In Uzbekistan, the *Gosbiokontrol* (State Bio-control), which is part of the State Committee on Nature Protection, has a predominant role of quota setting and enforcement. These come under the purview of the "Regulations on Hunting and Fishing on the territory of the Republic of Uzbekistan" (Mallon, 2013).

Furthermore, in Tajikistan, trophy hunting is primarily conducted by various conservancies, that are either owned by individuals or groups. There are several rangers and technicians within conservancies. For instance, about 140 rangers are employed in 10 Markhor hunting conservancies and they are employed either full time (up to 40 h a week) or part time (around 32 h on 4 out of 7 days). Trophy hunting is governed by the Committee of Environmental Protection of Tajikistan and they along with several Ministries determine the quota and the price of hunting licence. Benefit sharing, at least in the context of Markhor hunts in the country are divided into 25% for the conservancy (for salaries, taxes, equipment, etc.), 40% to the government, and 35% to the villages in and around the conservancies (Akramov *et al*., 2022). In Tajikistan private trophy hunting operations have already proven their market potential; the government received c. USD 770 000 from the sale of permits for 51

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legally harvested argali Ovis ammon polii in the 2010–2011 hunting season (Rosen, 2012).

Offtakes

Kazakhstan allows relatively high annual offtakes via trophy hunting, with an estimated total offtake of around 4500 individuals from 4 of its 5 trophy species. In Kazakhstan, relatively high offtakes via trophy hunting occur for Siberian roe deer (2021 in 1998), wild boar (1162 in 1998) and Siberian ibex (900 in 1998). Other countries have notably lower total annual offtakes via trophy hunting; for instance, 229 for 4 of the 7 trophy species in Pakistan (incl., 150 Siberian ibex in 2017–2018 and 49 urial in 2017–2018), 155 for 6 of the 9 trophy species in Mongolia (incl., 60 Siberian ibex in 2015 and 40 argali in 2015), and 126 for 3 of the 6 trophy species in Tajikistan (incl., 60 Siberian ibex in 2012–2013 and 51 argali in 2018–2019). Of the countries in Asia with established trophy hunting programmes, Nepal has one of the lowest total annual offtakes via trophy hunting: 22 for the 4 species that are hunted for trophy hunting in practice (incl., annual averages of 13 blue sheep and 7 Himalayan tahr from 2016–2021).

Russia allows relatively high offtakes of trophy species, with an estimated total annual offtake of over 15 000 individuals from only 4 of its 22 trophy species (Table 1): grey wolves (7074 in 2008–2009), Siberian musk deer (4235 in 2009–2010), brown bears (4215 in 2009–2010), and Eurasian lynx (340 in 2009–2010). However, these figures from Russia relate to total annual offtakes of trophy species as opposed to offtakes via trophy hunting alone.

Trophy exports

Twelve of the species identified in this study as being regularly targeted for trophy hunting in Asia are listed under CITES (Table 2). According to the CITES trade database (2010–2019) for these 12 CITES-listed species, Russia exported the most trophy items (473 trophies/year; 47.4% of total), followed by Kyrgyzstan (212 or 21.2% of total), Tajikistan (85 or 8.5%), and Mongolia (75 or 7.5%). The most exported trophies were from brown bear (395 trophies/year), argali (204 trophies/year), and Siberian ibex (173 trophies/year). More specifically, the most exported trophies were brown bear from Russia (395 trophies/year), Siberian ibex from Kyrgyzstan (108 trophies/year), and argali from Kyrgyzstan (88 trophies/year) (Table 2). In many cases, trophy exports were substantially lower than reported offtakes of the trophy species. Annual exports for Siberian ibex and blue sheep from Pakistan, for instance, were minor proportions of offtakes around a similar time (5.1% and 11.7%, respectively; Tables 1 vs. 2). Other figures were more comparable, such as for argali from Mongolia (offtakes: 51; exports: 53), Tajikistan (offtakes: 40; exports: 41) and Kyrgyzstan (offtakes: 80; exports: 88).

The USA was the main importer of trophies from 2010–2019 (346 trophies/year; 34.7% of total trophy records considered in the CITES database). Other prominent importers were Spain (79 trophies/year or 8.0% of total), Germany (68 trophies/year; 6.8% of total), and Mexico (52 trophies per/year or 5.2%). Also, the USA was the dominant importer of trophies for 10 of the 12 CITES-listed trophy species, including for markhor (35% of imports), urial (57%), and West Caucasian tur (35%; Table 3).

Permit prices for trophy hunting

The average permit prices at tender were highest for markhor in Pakistan ($62 000) and Tajikistan ($40 000) and then argali (around $15,000 in multiple countries) (Table 4). Yet, we identified cases of trophy hunts being sold for higher prices, such as a markhor hunt for $110 000 in Pakistan in 2019 (Ebrahim, 2019). The auction process of multiple countries in Asia to sell trophy hunts contributes to the variation in trophy hunting prices, as exhibited in Nepal where the minimum fee for foreigners is for blue sheep is around $1250 and for Himalayan tahr around $650, but the auction process for selling trophy hunts means hunters often bid up to $11 000 for hunts. The lowest average permit prices found were for wild boar ($100) and European roe deer ($220) in Turkey (Table 4).

Moderate geographic differences exist in the average permit prices at tender for certain species. For instance, the average blue sheep permit price in Pakistan ($9000) is around 7 times greater than the price in Nepal ($1250), and the average goitered gazelle permit price in Turkey ($3145) is almost 8 times greater than the price in Mongolia ($400). However, such geographic comparisons are not possible for many species as average permit prices are unknown.

Additionally, permit prices at tender can be smaller for domestic compared to international clients (Supporting Information Table S3). For example, in Pakistan, domestic hunters pay approximately $350–700 for an ibex, whereas international hunters will pay $2500–3000 or more (e.g. $3600; Kamran, 2020). Similarly, local hunters pay $50–70 while on-local citizens are charged c. $650 for urial whereas the hunting fee is $7000–12 000 for a urial or bezoar goat for international hunters in Iran. There are also cases where domestic and international hunters are charged similarly; for instance, for markhor in Pakistan (Nawaz *et al.*, 2016).

All countries considered have legislation that mandate a proportion of trophy hunting revenue to remain in the local area (Supporting Information Table S4). The countries that mandate the greatest share of trophy hunting revenue to remain in the local area are Mongolia (100%) and Pakistan (80%), and the countries with the lowest shares are Tajikistan and Turkey (40%). Yet, these proportions can vary within countries – for example, in Turkey, agreements between hunting authorities and village heads can specify up to 70–90% of trophy hunting income to the common budgets of local people in the village. In Iran, licence fees are deposited to the state-running National Environment Fund which then allocates income to anti-poaching activities or community conservation. Details on wider trophy hunting governance for each country can be found in Supporting Information Table S5.

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Table 2 Average annual quantity of trophy items of the 12 CITES-listed trophy species exported from Asian countries with major trophy hunting programmes over the 10-year period of 2010–2019

			West Asia			Central Asia				South Asia		Central Asia		
Family	Species		Azerbaijan	Iran	Turkey	Kazakhstan	Kyrgyzstan	Tajikistan	Uzbekistan	Nepal	Pakistan	Mongolia	Russia	Total
Bovidae	Bezoar goat	*Capra aegagrus*		0.5	50.4						11.4		0.1	62.4
	West Caucasian Tur	*Capra caucasica*											14.3	14.3
	Markhor	*Capra falconeri*						2.7	0.1		9.0			11.8
	Siberian Ibex	*Capra sibirica*				6.8	107.8	26.4			7.6	19.1	4.2	171.9
	Argali	*Ovis ammon*					87.7	52.5	1.2			41.3		182.7
	Urial	*Ovis vignei*		4.0				1.9			25.8			31.7
	Blue Sheep	*Pseudois nayaur*								8.5	2.1			10.6
Canidae	Grey Wolf	*Canis lupus*			0.1	9.4	16.3	1.7	0.1			13.9	28.2	69.7
Felidae	Eurasian Lynx	*Lynx lynx*											9.1	9.1
Moschidae	Siberian Musk Deer	*Moschus moschiferus*											1.3	1.3
Ursidae	Brown Bear	*Ursus arctos*											394.7	394.7
	Asiatic Black Bear	*Ursus thibetanus*											0.2	0.2

Summary of data obtained from the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) trade database. Figures are only presented if our study indicates that species are currently subject to established trophy hunting programmes in the respective country. Figures of >1 mean a quantity of >10 were exported over the 10-year period of 2010–2019.

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Table 3 Importer countries for trophies of the 12 Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)-listed trophy species from Asian countries (2010–2019) with relatively major trophy hunting programmes based on the CITES database. Species not mentioned in this table are not included in the CITES database

				Main importer countries		
Family	Species		Total exports (2010–2019)	Country 1 (%)	Country 2 (%)	Country 3 (%)
Bovidae	Bezoar goat	*Capra aegagrus*	625	USA (57%)	Spain (9%)	Mexico (6%)
	West Caucasian Tur	*Capra caucasica*	224	USA (35%)	Spain (30%)	Germany (10%)
	Markhor	*Capra falconeri*	125	USA (35%)	Canada (15%)	Mexico (13%)
	Siberian Ibex	*Capra sibirica*	1727	USA (43%)	Spain (13%)	Germany (5%)
	Argali	*Ovis ammon*	2038	USA (47%)	Mexico (11%)	Spain (8%)
	Urial	*Ovis vignei*	324	USA (57%)	Spain (2%)	Mexico (2%)
	Blue Sheep	*Pseudois nayaur*	108	USA (45%)	Spain (13%)	Mexico (6%)
Canidae	Grey Wolf	*Canis lupus*	697	Germany (14%)	France (10%)	China (8%)
Felidae	Eurasian Lynx	*Lynx lynx*	92	USA (11%)	France (11%)	Slovakia (10%)
Moschidae	Siberian Musk Deer	*Moschus moschiferus*	13	Hong Kong (46%)	France (23%)	USA (15%)
Ursidae	Brown Bear	*Ursus arctos*	3954	USA (24%)	Poland (9%)	Germany (9%)
	Asiatic Black Bear	*Ursus thibetanus*	2	USA (50%)	Ukraine (50%)	

Discussion

Established trophy hunting programmes are carried out in at least 11 countries across Asia, and target at least 30 species (plus one subspecies) of mammals. As outlined by our review, trophy hunting across Asia varies with regards to multiple ecological (e.g. area designated and species targeted) and socioeconomic (e.g. permit fees, revenue sharing, governance, and clientele) characteristics.

Ecological characteristics

In certain areas of Asia, trophy hunting has positively contributed towards conservation efforts (Woodford *et al.*, 2004; Bellon, 2008; Khyber Pakhtunkhwa Wildlife Act, 2015); for instance, by contributing to increased population sizes of targeted species in parts of Pakistan (Khan *et al.*, 2014; Ali *et al.*, 2015; Khan *et al.*, 2019; Khan & Baig, 2020) and Nepal (Aryal *et al.*, 2015). However, poorly managed trophy hunting programmes have also had negative ecological impacts in Asia, for instance by skewing the demographic structures in ungulate populations in Nepal (Aryal *et al.*, 2015), Pakistan (Khan *et al.*, 2019; Khattak *et al.*, 2020), and Turkey (Ambarlı, 2014), and reducing populations, like argali and ibex in Kyrgyzstan (Nordbø *et al.*, 2017) and Anatolian chamois in Turkey (Ambarlı, 2014). A main cause for negative ecological impact is inappropriate quotas, which may not be suitably evidence based (Aryal *et al.*, 2015; Rashid *et al.*, 2020) or not adequately area bound (Ahmad *et al.*, 2020; Haider *et al.*, 2021). This places an emphasis on developing evidence-based quotas for trophy hunting in Asia; especially for the 5 Vulnerable and 1 Endangered species (plus the 1 Endangered sub-species) targeted by established trophy hunting programmes. Alongside, there is evidence that prioritising an ungulate species for trophy hunting can result in negative perceptions among local community towards wild carnivores. This is because local communities might view the wild carnivores as competitors for the ungulates, especially large males that are often targeted as trophies (Rashid *et al.*, 2020). Therein, it is key to ensure that trophy hunting program, although primarily targeting a particular species, also take a holistic ecosystem approach in ensuring conservation goals are met.

The findings of this review also stress the considerable spatial scale of trophy hunting in some countries in Asia. For instance, even the 1 million km^2 of land designated for trophy hunting in Kazakhstan dwarves that of the areas for trophy hunting for the countries in sub-Saharan Africa (Lindsey *et al.*, 2007). Yet, despite such large spatial scales, much of the area over which trophy hunting is permitted in countries like Russia, Kazakhstan, and Turkey is not actively managed for trophy hunting, but rather animals are simply allowed to be shot. This differs from areas managed specifically and intensively for trophy hunting, like many hunting areas in sub-Saharan Africa (Loveridge *et al.*, 2007). The combination of trophy hunting being allowed over such large areas in several Asian countries with the relatively low intensity of management could have remarkable economic implications; for example, it could result in lower management costs while still yielding valuable benefits (e.g. revenue for outfitters, local communities, and countries).

Socioeconomic aspects

Trophy hunting in areas of Asia yields valuable economic benefits for local communities and countries (e.g. Pakistan: Ali *et al.*, 2015; Rashid *et al.*, 2020; Nepal: Aryal *et al.*, 2015); whilst, in other areas, it generates little economic benefit for local communities, which can lead to negative attitudes towards the industry (e.g. Kyrgyzstan: Nordbø *et al.*, 2017). Nevertheless, given the extent and diversity of trophy hunting in Asia, there has been relatively little research into its wider, multifaceted socioeconomic contributions to local people and countries.

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Table 4 Trophy hunting permit prices at tender (USD) for international clients across Asia (years for figures vary by species and country)

			West Asia			Central Asia				South Asia		Central Asia	
Family	Species		Azerbaijan	Iran	Turkey	Kazakhstan	Kyrgyzstan	Tajikistan	Uzbekistan	Nepal	Pakistan	Mongolia	Russia
Bovidae	Bezoar goat	*Capra aegagrus*		YES	1000–13 285[7]						YES		YES
	West Caucasian Tur	*Capra caucasica*											YES
	Dagestan Tur	*Capra cylindricornis*	YES										YES
	Markhor	*Capra falconeri*						40 000[1]	YES		62 000[5]		
	Siberian Ibex	*Capra sibirica*	YES			YES	4000[2]	YES	YES		3600[5]	2240[9]	YES
	Goitered Gazelle	*Gazella subgutturosa*		YES	3145[7]							400[11]	
	Himalayan Tahr	*Hemitragus jemlahicus*								650[4]			
	Argali	*Ovis ammon*					14 000[2]	9000[1]	15 000[8]			15 200[3]	YES
	Mouflon	*Ovis gmelini*		YES	20 820[7]						YES		
	Red Sheep	*Ovis gmelini x Ovis vignei*		YES									
	Snow Sheep	*Ovis nivicola*											YES
	Urial	*Ovis vignei*		YES				YES			11 250[6]		
	Mongolian Gazelle	*Procapra gutturosa*										200[11]	YES
	Blue Sheep	*Pseudois nayaur*								1250[4]	9000[10]		
	Chamois	*Rupicapra rupicapra*	YES		1285–6285[7]								YES
Canidae	Grey Wolf	*Canis lupus*	YES		YES	YES	YES	YES	YES			YES	YES
Cervidae	Moose	*Alces alces*											YES
	European Roe Deer	*Capreolus capreolus*			220[7]	YES						YES	YES
	Siberian Roe Deer	*Capreolus pygargus*	YES			YES	YES					YES	YES
	Elk	*Cervus canadensis*				YES							YES
	Red Deer	*Cervus elaphus*	YES		1285–5000[7]	YES						1280[11]	YES
	Sika Deer	*Cervus nippon*	YES										YES
	Indian Muntjac	*Muntiacus muntjak*								YES			
	Whitetail Deer	*Odocoileus virginianus*											YES
	Reindeer	*Rangifer tarandus*											YES
Felidae	Eurasian Lynx	*Lynx lynx*											YES
Moschidae	Siberian Musk Deer	*Moschus moschiferus*											YES
Mustelidae	Wolverine	*Gulo gulo*											YES
Suidae	Wild Boar	*Sus scrofa*	YES	YES	100[7]	YES	YES	YES	YES	YES		YES	YES
Ursidae	Brown Bear	*Ursus arctos*	YES		YES						YES		YES
	Asiatic Black Bear	*Ursus thibetanus*											YES

References and relevant year(s): 1. Michel *et al.* (2015) for 2014; 2. Anarbaev (2013) for 2013; 3. Y. Onon (2021; pers. comm.) with US$19 200 for Altai argali and US$11 200 for Gobi argali for (presumably) 2020–2021; 4. G. Khanal (2021; pers. comm.); 5. Kamran (2020) for 2020; 6. Saif (2017) for 2017–2018; 7. Anonymous (2020) for starting price at tender for 2020, meaning figures are minimum values; 8. Mallon (2013) for 2004–2005; 9. Y. Onon (2021; pers. comm.) with US$2400 for Altai ibex and US$2080 for Gobi ibex for (presumably) 2020–2021; 10. Nagri (2017) for 2017–2018; 11. Y. Onon (2021; pers. comm.) for (presumably) 2020-2021. 'YES', denotes that the species is trophy hunted in that country but a recent estimate for trophy hunting permit price could not be obtained.

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In relation to a component of the socioeconomic impacts of trophy hunting, our review found that average permit prices differ between species and countries, from $100 for wild boar in Turkey to $62 000 for markhor in Pakistan. This variation may relate to differences in body size, rarity, and charismatic appeal (Johnson *et al*., 2010). In Mongolia, for instance, the heavier argali commands a greater permit price ($3000) than Siberian ibex ($470). In Pakistan, charisma may be the key factor in determining differences in permit prices for markhor ($62 000), urial ($11 250), blue sheep ($8000) and Siberian Ibex ($3600), given the apparently minor differences in body size and rarity. For certain species, permit prices differ moderately between countries. This variation may, in part, arise because countries contain different subspecies or offer a different standard of hunting experience. However, cases of notable differences in permit prices might indicate an opportunity for certain countries to raise permit prices at tender and thereby increase trophy hunting revenue. Increasing permit prices in this way could mean that fewer animals need to be hunted in order to generate an equivalent (or greater) revenue, which may also promote trophy hunting sustainability. The potential to raise prices also means the scale of incentives for wildlife conservation could be increased – in various contexts this will result in increased benefits for conservation than decreasing quotas. Furthermore, issues such as poaching and the loss/degradation of habitat can be countered by well-managed hunting if the benefits reach the right places such as the local community and governments (Shackleton, 2001; Frisina, Awan, & Woodford, 2007; Frisina & Frisina, 2012; Di Minin *et al*., 2016). Higher prices of local trophy hunts are likely to also incentivise trophy hunting over meat-oriented domestic livestock industry, which across various areas of High Asia are known to degrade rangelands and also can be a source of negative human-wildlife interactions (Mishra *et al*., 2022).

As trophy hunting can be considered a tool to promote community stewardship over natural resources (Mkanda, Mwakifwamba, & Simpamba, 2014), many countries in Asia have legislation decrees that local people receive a defined share of trophy hunting revenue, from around 40% as a mandated minimum in areas of Turkey and Tajikistan to 100% in Mongolia. These revenues come in various forms including revenues accruing to governments through permits which are then transmitted to the communities or the community directly negotiating for fees with the herders. However, there are cases when locals receive few or no benefits from trophy hunting for various reasons, including in places where there might be good legislation which does not necessarily translate into practice. This is often due to poor legislation, inadequate legislation for benefit sharing, disputed ownership rights or corruption (Amgalanbaatar *et al*., 2002; Harris & Pletscher, 2002; Michel *et al*., 2015; Nordbø *et al*., 2017). Nevertheless, it is important to note that alongside the monetary benefits derived from trophy hunting it is also crucial to understand and uphold the rights, particularly of local communities, to manage the wildlife and their habitats themselves. This is critical to communities in terms of incentivising conservation, and also being able to secure benefits themselves (Adhikari *et al*., 2021).

Examination of the CITES trade data provided a complementary perspective on trophy hunting in countries in Asia to information from published and unpublished literature. First, we identify major differences between annual exports in the CITES trade data and reported annual offtakes via trophy hunting for various species and countries. Such discrepancies might arise for several reasons, including as a result of trophy hunting by domestic hunters, which would not involve trophy export and would therefore be below the scope of CITES. Notably, in some cases, permits for domestic hunters outnumber those for internationals hunters, like for Siberian ibex in Kyrgyzstan in 2014 (400 for domestic vs. for 250 international hunters; Michel *et al*., 2015). Similarly, only 35% of Iran's trophy permits issued in 2018 were for international hunters. Nevertheless, this discrepancy highlights that using only CITES data risks misrepresenting the extent of trophy hunting occurring within a country. Second, our consideration of the CITES data stresses the prominence of international hunting from the USA in trophy hunting across Asia. This dominance of trophy hunters from the USA echoes findings from sub-Saharan Africa (Lindsey *et al*., 2007). It also means that any changes in US legislation for the import of trophies from trophy hunting could have a large and pervasive effect on trophy hunting in Asia.

Recommendations

Reflecting on the findings of this review, we provide five key recommendations for future research that would inform evidence-based policy:

1 Ecological impact assessments: Trophy hunting can impose range of demographic effects ranging from positive to negative to deleterious; however, there is still a lack of demographic data for the impacts of harvesting on mammal populations in Asia. The limited existing data is mainly skewed towards non-threatened species (Siberian ibex: Raza *et al*., 2015; Khan *et al*., 2019; Ahmad *et al*., 2020; Blue sheep: Aryal *et al*., 2015; Khattak *et al*., 2020, Argali: Amgalanbaatar *et al*., 2002; Harris & Pletscher, 2002; Himalayan tahr: Aryal *et al*., 2015), while threatened ungulates like goitered gazelle, and West Caucasian tur, which are potentially prone to deleterious demographic impacts, are rarely studied.
2 Socioeconomic impact assessments: Trophy hunting has multifaceted socioeconomic effects, yet only a few studies have focussed on this aspect of trophy hunting in Asia (Harris & Pletscher, 2002; Ali *et al*., 2015; Aryal *et al*., 2015; Nordbø *et al*., 2017; Rashid *et al*., 2020). Thus, further research is needed on the governance, revenue sharing, and benefits accrued to local communities. Also, there is evidence that illegal hunting is likely prevalent in various areas by local communities, in some cases more than the number of trophy hunts. Therein, more

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research is needed, which can be guided by management strategy evaluation models, to understand what incentives can be provided to local people to monitor and comply with trophy hunting regulation over engaging in illegal hunting (Bunnefeld *et al*., 2013).

3 Contribution of trophy hunting to conservation spending and outcomes: Trophy hunting is often perceived as a management tool for generating necessary resources for the protection of biodiversity (Lindsey *et al*., 2007; Di Minin *et al*., 2016). However, the financial contribution of the industry to conservation spending of the Asian countries is not yet known. It would therefore be valuable to estimate the total revenue generated by trophy hunting in each country. Additionally, given the high percentages of the revenue that are mandated to be allocated locally in many countries in Asia (both for conservation spending and enhancing local livelihoods), it is crucial that the actual contribution of the permit revenues at local levels be evaluated. Linked to this, as conservation benefits are closely linked to ecological outcomes, more research is needed to understand not only the contributions to local, regional and national economies/livelihoods, but also who gains them and their magnitude, as these are critical in determining ecological outcomes. It is not just proximate ecological impacts of trophy hunting that are important and need further research, but the extent to which the control, distribution, and level of benefits incentivise or enable conservation.

4 Contribution to the post-2020 Global Biodiversity Framework: Target 2 of the next generation of the Convention on Biological Diversity's post-2020 Global Biodiversity Framework is to protect at least 30% of the planet by 2030. Recently, "other effective area-based conservation measures" (OECMs) have been endorsed to supplement this target (CBD, 2018; Dudley *et al*., 2018). OECMs are defined as "geographically defined areas other than PAs, governed to achieve positive biodiversity conservation outcomes with associated ecosystem functions and services as well as cultural, spiritual, socio–economic, and other locally relevant values". Given the sizes of trophy hunting areas in many countries in Asia, their inclusion as OECMs, if properly managed to deliver ecological and socioeconomic benefits, should be evaluated (Farhadinia *et al*., 2022).

5 Further examination of perceptions of trophy hunting: Public perceptions of trophy hunting for conservation are often recognised to strongly oppose the practice (Nelson *et al*., 2013; Macdonald *et al*., 2016; Batavia *et al*., 2018). However, in many areas, including areas across Asia, local perceptions of trophy hunting can be largely positive as it yields valuable benefits (Angula *et al*., 2018; Rashid *et al*., 2020; Adhikari *et al*., 2021). Whilst simultaneously satisfying these conflicting perspectives is challenging, further research into how and why different groups differ in their perceptions of trophy hunting for conservation could provide valuable insights for evaluating the appropriateness of different policies.

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Supporting information

Additional supporting information may be found online in the Supporting Information section at the end of the article.

Table S1. Outfitters considered to determine the taxonomic and geographical scope of this study.

Table S2. Source types for the different ecological and socioeconomic characteristics of trophy hunting considered in this study.

Table S3. Examples of differentiating domestic and international permit prices.

Table S4. Legally mandated proportions of trophy hunting revenue accrued by the central government versus that which remains in the local area.

Table S5. Summary of trophy hunting governance across Asia.

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