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Bane or Blessing? Reviewing Cultural Values of Bats Across the Asia-Pacific Region

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Abstract. Chiroptophobia, or the fear of bats, which encompasses negative perceptions of bats as disease vectors, pests, or harmful creatures associated with evil spirits, represents an important barrier to bat conservation globally. Derived largely from the influence of Western cultural perceptions, it ignores the diverse cultural perceptions of bats from other regions, which have been largely overlooked. To better understand local beliefs and cultural perceptions regarding bats across the Asia-Pacific region, and how they may help design culturally grounded conservation strategies, we conducted a review of publications in the English-language literature documenting cultural value of bats in Asia-Pacific traditions. We discovered 119 bat cultural values in 60 different cultures from 24 countries across the region and found a wide spectrum of reports, which we categorized according to five wildlife value categories and further categorized these values according to positive, neutral, and negative. We found that 62% of the cultures had only positive values, 8% had only neutral values, while 10% had only negative values. This suggests that the Asia-Pacific region and its cultures contain far more positive associations with bats than most Western societies and, as such, offer promising examples and opportunities to promote human-bat coexistence. However, we also discuss how local belief systems may not always align with daily practices or conservation objectives. We suggest employing targeted, culturally grounded and locally contextualized outreach strategies in order to carry out more effective bat conservation and education in Asia-Pacific countries.

Keywords: bats, beliefs, conservation, symbolism, mythology

Introduction

Sociocultural representations of animals as "good" or "evil" have persisted throughout history (Baker 2001; Forth 2017). This dichotomy can influence attitudes that impact the success of conservation strategies, which may result in the conservation or destruction of a species; an "evil" animal might be deemed less worthy of conservation than a "good" animal (Fernández-Llamazares and Cabeza 2018; Stokes 2007). Additionally, current economic motivations can

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often supersede and erode cultural values in relation to nature (Western et al. 2019), sometimes resulting in over-harvesting of certain species, leading to irreversible biocultural losses. Bats are no strangers to such polarizing interpretations (Kingston 2016). These nocturnal animals with elusive habits have been often associated with evil (Allen 1939). The phenomenon of chiroptophobia—an irrational fear of bats—may be related to the pervasiveness of Western cultural associations of bats with devils and witchcraft (Lunney and Moon 2011; Tuttle 2018), which have been recorded in Christian tradition as early as the fourteenth century (Tatai 2006; see also Eklöf and Rydell 2021). Such historical chiroptophobia, along with current media sensationalizing bats and zoonoses, are major hindrances towards bat conservation (López-Baucells et al. 2018; Rocha et al. 2020).

Additionally, bats are associated with vampires in Western culture (e.g., Prokop et al. 2009; Rydell et al. 2018)—folklore with roots in a Russian myth of a reanimated corpse that feeds on human blood, dating back to the eleventh century (Cooper 2005). The association may have come about due to vampire hysteria in Europe influencing the observations of early naturalists encountering tropical bat species. This initial ecological-taxonomic bias has left its mark on species nomenclature today, with non-sanguivorous bat species (e.g., *Pteropus vampyrus*, *Vampyressa* spp.) having names relating to haemophagy (Schutt 2008).

In contrast, since the fourteenth century, Chinese culture has associated bats with good luck and blessings (Eberhard 1986). These lucky bat symbols were prevalent in Chinese arts throughout the centuries, but this symbolic concept struggles to find its place in larger global narratives about bats today, and bat symbolism in other Asian cultures remains largely unknown. To date, ethnobiological information regarding bats throughout the Asia-Pacific region has mainly focused on utilitarian aspects of bats as food and medicine (Kingston 2016; Mildenstein et al. 2016; Riccucci 2012), whereas knowledge concerning symbolism and beliefs surrounding bats across the region has not been assembled, apart from Polynesian (Sinavaiana and Enright 1992) and Southwest Asian cultures (Frembgen 1999, 2006). Collating this knowledge now is crucial because many of the biocultural systems in which bat knowledge is embedded are increasingly superseded and supplanted by the influence of Western culture (e.g., McCarter et al. 2014; Tang and Gavin 2016), and such systemic shifts can have negative implications for bat conservation efforts across the region. There is an urgent need to reclaim, revitalize, and capitalize on positive bat symbolisms embedded within Asia-Pacific cultures.

As such, we conducted a literature review with the specific objectives of 1) examining the English-language literature to obtain records of cultural values surrounding bats across the Asia-Pacific region; 2) understanding the breadth of these values by categorizing them and determining the number of overall positive, neutral, and negative values; and 3) summarizing this literature to guide bat conservation efforts. This review advances fundamental understanding of the lesser-known sociocultural representations of bats across the Asia-Pacific region, with the goal of guiding culturally grounded and effective bat conservation strategies.

Methods

We reviewed published and grey English-language literature documenting Asia-Pacific cultural values of bats. We defined "Asia-Pacific" as comprising East Asia, South Asia, Southeast Asia, and Oceania (United Nations 2020). We defined "cultural values of bats" as representations of bats found either in traditional art forms or folklore, and traditional hunting, consumption, or trade of actual bats or their by-products, particularly if tied to traditional cultural beliefs.

We assembled literature for a non-exhaustive review using the following: database searches in JSTOR and Web of Science using the terms ("bat" OR "chiroptera") AND ("symbolism" OR "folklore") OR ("East Asia" OR "South Asia" OR "Southeast Asia" OR "Oceania" OR "Pacific"); additional sources from forward and back citations of key articles; grey literature search in Google Scholar; primary and secondary information from the National Library of Malaysia's anthropological accounts; opportunistic information from popular articles, websites, and blogs; our own local knowledge; and, finally, gap-filling literature was also included, based on recommendations from colleagues working on bat-related research, reviewers, and editors. Data were not available for all Asia-Pacific countries, possibly due to a lack of records in English. This yielded a total of 119 records, providing the most comprehensive review of bat cultural values across the Asia-Pacific region to date.

We categorized these values according to five categories (Table 1) adapted from the wildlife values identified by Kellert (2008), and further assessed each individual value as being "positive," "neutral," or "negative." We considered beliefs where bats were regarded as sacred, beneficial, or a desirable aesthetic as "positive"; beliefs primarily associated with the natural position or role of bats in nature as "neutral"; beliefs that associated bats solely with malignance or malevolence as "negative." We acknowledge that these categories involve frequent overlap and/or no exact fit, but allow for a condensed overview of how representations of bats in Asia-Pacific cultures are reported in English-language literature. Throughout this review we use the term "fruit bats" for all species in the family Pteropodidae, whereas "flying foxes" refer only to the genera *Pteropus*, *Acerodon*, and *Desmalopex*.

Results

We obtained 119 records of bat cultural values: 38% from journal articles, 29% from books, 24% from the authors' local knowledge, 4% from websites, 3% from popular articles, 2% from unpublished theses, and 1% from a conference paper. Of the 60 different cultures in 24 countries, 62% had only positive values, 8% had only neutral values, while 10% had only negative bat cultural values. The remaining cultures had combinations of positive, neutral, and negative values (Table 2 and Supplementary Table 1).

Aesthetic-Symbolic

Motifs

Bats—in recognizable or abstract forms—serve as inspiration and motifs in art forms. Ethnic Chinese communities regard bats as lucky animals, with the belief based on homonymic wordplay on the words bat 蝠 (*fú*) and blessing 福 (*fú*), recorded as early as the Shang dynasty (1300–1050 CE; National Museum of China 2020). Lucky bat motifs are found in architecture, paintings, ceramics, jewelry, and textiles (Supple-

Table 1. Definitions and functions of wildlife values adapted from Kellert (2008).

Wildlife value	Definition and function
Aesthetic-Symbolic	Used as visual motifs that are physically attractive and/or express a deeper symbolic meaning
Humanistic	Represented as being human-like, and/or demonstrating humans' emotional bond with nature
Moralistic-Negativistic	Viewed in relation to spiritual/moral standards, inspiring awe and reverence, and/or fear and aversion
Naturalistic	Described/included in a narrative explaining the order in nature
Utilitarian	Bats and/or bat by-products are consumed or traded

Table 2. Percentages of positive, neutral, and negative cultural values of bats across Asia-Pacific cultures found in this review (n = 60).

Values	% of values
Positive only	62
Neutral only	8
Negative only	10
Positive and neutral only	12
Neutral and negative only	2
Positive and negative only	3
Positive, neutral, and negative	3

mentary Figure 1) in China (National Museum of China 2020), Indonesia, Malaysia, Singapore, Thailand (Tan 2003), Japan (Lyon Collection 2013), Laos (Utiswannakul 2018), South Korea (Kim 2017), Taiwan (Yang and Hsu 2016), and Vietnam (Pham and Lee 2008). Bat-inspired motifs can also be found in textiles from Malaysia and Indonesia, as with the Malay/Javanese *siku keluang* (flying fox's elbow) motif in *batik* and *songket* (Husin 2006; Mohamad 2005; Supplementary Figure 1); the *batik lawa* textile design in Purbalingga, Indonesia (Sheherazade, unpublished data); and in Iban *pua kumbu* textiles and woven rattan crafts (L. A. Bansa, unpublished data).

Flying foxes are also associated with warriors as a traditional Iban tattoo motif (*semawa*) in Sarawak, Malaysian Borneo (Ganjing 1988; Supplementary Figure 1), and a Samoan coming-of-age tattoo (*pe'a*) symbolizing protection over a male warrior (Wendt 1996). New Guinea islanders used flying fox motifs (*tar*) on war shields, symbolizing triumph for the head-hunting Asmat of Indonesia (Smidt 1993), representing shapeshifting shamans for the Trobriand of Papua New Guinea (Leach 1954).

Naturalistic

Species Transmutations

Nage in Flores, Indonesia, believe that bats undergo metamorphoses: small bats, *ighu*, form from bamboo grubs which transform into larger bats, *gebu*, eventually becoming *méte*—large fruit bats, which then transform into palm civets (Forth 2004, 2009, 2021). A Mah Meri legend from Peninsular Malaysia tells that flying foxes originated from the dead black dog of an old woman, after she cooked it according to instructions from an ancestor in a dream (Wazir-Jahan 1981). Mortlock folklore from Micronesia relates a deal between the rat and bat that soured: the rat stole the bat's wings and became modern-day bats; the original bat became a rat upon losing its wings (Buden et al. 2013).

Ecological Roles

In Australia, Badmardi and Jawoyn of Arnhem Land believe flying foxes are kinsfolk to the Rainbow Snake, as featured in ancient rock art (Tacon et al. 1996), while Yanyuwa of the Torres Straits believe that a natural cloud formation, known as Morning Glory, appearing before the wet season helps to spread seed dispersers, including flying foxes, across the country (Bradley et al. 2006). An early nineteenth century Malay children's rhyme from Peninsular Malaysia featured a fruit bat flying away with a banana fruit (Skeat 1900:501), while the popular folk song *Kang Kao Kin Kluay* in Thailand describes the conflict between farmers and deceitful fruit bat thieves who eat bananas (T. Sritongchuay, unpublished

data). The Japanese word for bat, *kōmori*, may originate from "mosquito slaughterer" (J. H. Preble, unpublished data).

Ethno-taxonomy

Several cultures categorize different species of bats with other animal taxa, rather than its own distinct group. In northern Thailand, bats are known as *meng tham,* meaning "insects in caves," and *i-kea,* meaning "insects that have ears like rabbits" (Suwannarong et al. 2020). Yamato Japanese and Ainu in Japan recognized bats as ambiguous creatures, but generally grouped them with birds rather than "beasts" (i.e., four-legged terrestrial mammals) because bats fly (Yamada 2001). Bhutanese folklore tells how bats would claim to be either birds or beasts to conveniently evade taxes from either group or to claim food supplies from both groups, eventually leading to their ostracization (Phuntsho 2000). Yanyuwa from Torres Straits, Australia, consider flying foxes as *julaki*, which groups together all flying animals, including birds and dragonflies (Bradley et al. 2006), whereas Nage of Indonesia group bats together with birds (Forth 2009). Newars from Nepal classify smaller bats as "house bats" and larger fruit bats as "tree bats" (Tuladhar-Douglas 2008). In Myanmar, flying foxes are differentiated from other bats by the name *linn swaè*, meaning "animals hanging from trees" (M. M. Aung, unpublished data).

Indications of Natural Phenomena

In Myanmar, flying fox emergence time is believed to indicate the weather: an early or no emergence foretells a coming storm (M. M. Aung, unpublished data). In the Philippines, unusual bat behavior is believed to foretell natural disasters, such as earthquakes or volcanic eruptions (L. M. Paguntalan, unpublished data). In India, 2000-year-old Tamil Sangam prose features bats as allegories for evening time and seasonal change (B. Murugavel, unpublished data). In Sarawak, Malaysian Borneo, an Iban children's rhyme sung at bedtime featured flying foxes and coincided with the evening emergence of *Pteropus vampyrus* (Gumal et al. 1998). In Australia's Northern Territory, the Yarralin believe that flying foxes call the Rainbow Snake creation deity to bring rain (Rose 2010).

Humanistic

Anthropomorphic Representations

Yarralin of the Northern Territories, Australia, describe flying fox stragglers during evening flyouts as "blokes" who "forgot their axes" (Rose 2010). Australian Aborigine rock art in Kakadu features figures thought to be "flying fox men" holding spears (Welch 1992). The formerly head-hunting Asmat of Papua province, Indonesia, considered flying foxes to be head-hunters too, taking the "head" of the tree by consuming its fruit (Smidt 1993). Among Samoans, flying foxes are said to be cheeky and courageous, making it a desired tattoo motif for those who identify with its nature (Wendt 1996).

Emotional Affinity with Nature

Samoan legend tells of how the Tongan king's Samoan wife, Leutogi, was rescued by flying foxes (Henry 1983; Sinavaiana and Enright 1992) and she later honored her rescuers by naming her son *Tonumaipe'a*, meaning "rescued by flying foxes" (N. Mariner, unpublished data). Some communities in Vanuatu consider *Pteropus tonganus* as their ancestors and are said to be able to communicate with them (Bani 1992).

In the Malay *zapin* folk dance of Malaysia, the *siku keluang* ("flying fox's elbow") step represents humility and restraint from unnecessarily displaying power, referencing how flying foxes fold up their enormous wings when roosting (Nor 2007). Flying fox behavior also serves as inspiration in the Mah Meri song and dance *kuang kuwait,* mimicking their flight movements (Chan 2015; Maznah Unyan, pers. comm., September 2020). Bats are also used as allegories to denote romantic or parental

love in the poetry of India's Tamil Sangam literature (B. Murugavel, unpublished data).

Moralistic-Negativistic

Sacred Animals

Bats are revered throughout India. In Madurai, Tamil Nadu, worshippers of the god Muni regard *Pteropus giganteus* as sacred and protect colonies for fear of divine punishment. However, dead bats found on the ground can be consumed after offering prayers (Marimuthu 1988). In Pudukottai, Tamil Nadu, devotees of the goddess Kali worship *P. giganteus* roosting in sacred groves as guardians (Tangavelou et al. 2013). In Bihar, worshippers of the goddess of wealth Laxmi believe *P. giganteus* helps bring wealth. A bat temple in Assam, at the entrance of a mixed-species bat cave, has hosted festivals since 2001 (B. Murugavel, unpublished data).

Samoan folklore tells how the war god Sepo the Strong took the form of a flying fox to forewarn his people in battle; victory was near if a flying fox flew ahead of them, but one flying towards them was a warning to retreat (Frazer 1887). Bowi folklore of East Sepik features a giant female flying fox, *Kinjinmbunduo*, feared yet revered for her immense size and strength, which caused disaster but also brought blessing (Motou 2013). Ainu in Japan reportedly worshipped the crafty and wise bat god *kappa kamui*, who kept away disease and demons (Batchelor 1901).

Wat Mahatup Temple devotees in Soc Trang, Vietnam, see the resident colony of flying foxes that circle the temple at dusk as an invocation of Buddha's blessing (Tsang et al. 2016) and, in northern Thailand, bats are believed to be sacred animals belonging to a Buddhist monk (Suwannarong et al. 2020). Villagers and orchard owners in Myanmar believe that allowing bats to roost and feed ensures prosperity and well-being (M. M. Aung, unpublished data). Such a belief also exists across South Sulawesi, Indonesia: a predominantly Bugis community in Sidrap believes that flying foxes roosting near their rice fields guarantee bountiful yields, and the city of Watansoppeng erected a statue and introduced local regulations to venerate and protect their flying foxes (Sheherazade, unpublished data). Similarly, fishing communities in Zamboanga Sibugay and Bohol, Philippines, consider flying foxes roosting in nearby mangroves to be guardians of their fishing grounds who increase fish and shellfish abundance (L. M. Paguntalan, unpublished data). Manuvu and B'laan from Mindanao, Philippines, believe that bats act as night guardians (Tanalgo 2017).

Confucian texts (403–221 BCE) from China describe bats as creatures of permanence, as they have good eyesight, the ability to hang upside down, are thought to live up to a millennium, or even possess immortality (Ye 2007). Zhang Guolao, one of the Eight Immortals in Taoism, was described as a white spiritual bat who escaped the primeval chaos (Wu et al. 2011). Bats were said to assist the legendary Chinese demon hunter Zhong Kui, as depicted in paintings and traditional opera (Eberhard 1986).

Shamanic Creatures, Harbingers, and Omens

In Malaysia, ethnic Han Chinese believe that a bat entering one's house is a good omen (Rimba, unpublished data). Similarly, Sarawakian Ibans of Malaysian Borneo believe that a bat flying into the house indicates a shaman (*manang*) bringing good vibes (*chelap*), conferring protection against harm (L. A. Bansa, unpublished data). In Thailand, a bat that enters a house but immediately flies out is believed to change bad luck to good, although if the bat stays and eats fruit in the house, bad luck will befall the owner (T. Sritongchuay, unpublished data). Although Nage of Flores, Indonesia, do not associate bats with shamans, witches, or spirits (unlike birds which bats are ethno-taxonomically grouped with), they do believe that a bat

flying into a house and alighting there is a taboo (*pie*) that can lead to extinction of the human residents—but a bat only entering without alighting is harmless (Forth 2009).

Sarawakian Ibans also believe a pair of bats act as shamanic spiritual messengers who journey to the upper-world during *Gawai* harvest festival rituals (Sather 2008). In Papua New Guinea, bats symbolize bush spirits associated with male hunting events in a Chachet dance (Corbin 1986). In Papua New Guinea, Trobriand women shamans (*yoyova*) were said to give birth to shamanic creatures, in the form of flying foxes, to do their bidding (Malinowski 1922), and war shields were decorated with flying fox figures to symbolize a shaman's shapeshifting form in flight (Leach 1954). Nidula of Goodenough Island regarded cave bats (*manukiki*) and flying foxes (*manuboyi*) as sorcerers' messengers (Young 1981). Rindi in Sumba Island, Indonesia, believe that spirits (*pahomba*) take on the form of small bats (Forth 1981, 2016).

Taboos against Harming Bats

Semai in Perak, Peninsular Malaysia, do not hunt or consume flying foxes to avoid the consequences of the animal's *saka*: harm that befalls a human who disturbs a disembodied spirit or force (Wong Z. H., unpublished data). Berawan in Sarawak, Malaysian Borneo, consider it a taboo to disturb a fruit bat. If a man whose wife is nearing childbirth unthinkingly does so, harm may befall the unborn child (Metcalf 1982). In Sri Lanka, it was considered a sin to kill a bat, because bats do not come down to the ground (Simon 1954). Mah Meri from Selangor, Peninsular Malaysia, have a cautionary tale featuring a bat in the form of an old woman who takes revenge on siblings who tried to kill and eat the bat (Julida Anak Uju and Maznah Unyan, pers. comm., September 2020). In northern Thailand, since bats are sacred for Buddhists, harming bats incurs a curse (Suwannarong et al. 2020). Wik folklore of Cape York, Australia, relates how two boys who killed flying foxes were punished by other flying foxes, carried up into space and left there as a grim reminder in the form of the Gemini constellation (Richards et al. 2012).

Malevolent, Feared Spirits

In north and northeastern Thailand, a bat active in daytime or the sight of bats flying around a temple portends a person's death (Suwannarong et al. 2020). In New Zealand, Māori associate bats, *pekapeka*, with the mythical nocturnal bird *hokioi* that foretells death (Mead and Grove 2003). Huaulu of Maluku associate bats with people who have died a violent death (Valeri 2000), while Batak of Sumatra regard flying foxes as embodying malevolent spirits (Thiessen 1914). In Pakistan, people believe that bats roosting near one's home would bring misfortune. Bats were also believed to enter one's ear, never to be removed, and contact with bat urine was thought to cause eczema (Mahmood-ul-Hassan et al. 2011). In Sri Lanka, it was believed that one may be reincarnated as a bat for denying another person drinking water (Simon 1954).

In Japanese mythology, very old bats can transform into *nobusuma*, spirit animals resembling flying squirrels that land on their victims' faces at night to feed off blood (Meyer 2015). Ilocano living near caves in south-central Mindanao, Manuvu, and B'laan from Mount Apo, Mindanao, Philippines, associate bats with the myth of the fearsome *aswang* and *manananggal* demon spirits that prey on pregnant women and human livers (Mildenstein 2013; Tanalgo 2017); the former can assume bat form when hunting, whereas the latter is a female human with bat-like wings, able to detach its upper torso and fly (Tanalgo 2017; Tanalgo et al. 2016). The origin of the bat association is unclear, as Malay and Javanese myths tell of similar spirits (e.g., *penanggal*, *sundal bolong*) which are not associated with bats (Nadeau 2011), so it could be a cultural by-product of Catholic Spanish colonialism (Meñez 1996).

Utilitarian

Consumption and Use of Bats

Bats—especially flying foxes—are widely consumed as food and medicine throughout Asia-Pacific cultures. Previous reviews indicate that such practices are common across Southeast Asia, except in Brunei and Singapore (although flying fox hunting was documented in Singapore until local populations were extirpated [Low and Pocklington 2019]), and also Australia, Bangladesh, China, India, Japan (until the twentieth century; Vincenot 2017), Nepal, Taiwan and the Pacific islands of Micronesia, New Caledonia, Palau, Samoa, Solomon Islands, and Vanuatu (Bani 1992; Epstein et al. 2009; Harrison et al. 2011; Mickleburgh et al. 2009; Mildenstein et al. 2016; Oedin et al. 2019; Raymundo and Caballes 2016; Suwannarong et al. 2020). Due to the large amount of existing information on bat consumption, only information not presented in previous reviews is included here.

In Nagaland, India, Longpfurii hold an annual bat-harvesting festival where 7000–25,000 cave-dwelling bats (*Eonycteris spelaea, Hipposideros armiger*, and *Rousettus leschenaultii*) are harvested by smoking the cave (Dovih 2015). In Peninsular Malaysia, cave species, such as *E. spelaea*, were also hunted by Jakun in the late nineteenth century (Hornaday 1885) and, in the early twentieth century, Temuan in Melaka were recorded consuming an entire colony of unknown species (Skeat and Blagden 1906).

Ethnic Han Chinese, non-Muslim Indigenous groups, and ethnic Malays in Peninsular Malaysia hunt flying foxes, often using guns, although the latter do not consume the bats but trade their catch to the Chinese, who consider it a delicacy (Tom Hughes, pers. comm., February 2019). This practice was common until the 1980s, after which flying foxes became increasingly rare, although Jakun in Pahang (Rimba, unpublished data) and Semai in Perak (Tan Poai Ean, pers. comm., August 2020) continue to consider flying foxes a delicacy today. Iban in Sarawak, Malaysian Borneo, served guests toasted bats (Hose and McDougall 1966) and continue to hunt and eat flying foxes today (Gumal 2011; Mohd-Azlan Jayasilan, pers. comm., May 2018). Iban in Kalimantan, Indonesian Borneo, also hunt fruit bats for consumption (Wadley and Colfer 2004) and predominantly Christian Minahasan in North Sulawesi regularly consume flying foxes (*Pteropus alecto* and *Acerodon celebensis*), with peak consumption during Christmas, New Year, and harvest festivities (Sheherazade and Tsang 2015). In Australia, Karuah in New South Wales consumed flying foxes, possibly *Pteropus poliocephalus* and *P. scapulatus* (Byrne 1987), while Yanyuwa from Arnhem Land hunted and consumed flying foxes at peak flowering season and regarded the internal organs as a delicacy (Bradley et al. 2006). Māori in New Zealand were known to eat small bats (Best 1977). Samoans prize flying fox meat as a delicacy and as a gift to elders, but commercial hunting and export of the meat is culturally frowned upon (Sinavaiana and Enright 1992). In Makira, Solomon Islands, where traditional currency is valued for transactions, such as bride price and compensation, the canine teeth of larger *Pteropus tonganus*, instead of those of smaller *P. cognatus*, are the second most highly valued currency after shell money and, for this reason, the former is targeted more by hunters (Lavery and Fasi 2017).

There exists a widespread regional belief that bat meat consumption cures asthma: among ethnic Han Chinese of Peninsular Malaysia (Aziz et al. 2017a; Fujita 1988); Iban and Penan of Malaysian Borneo, who attribute the cure to the bats' "strong wings and lungs" (Ellen McArthur, pers. comm., March 2020); communities in North Sulawesi, Indonesia, who specifically consume the bats' livers and hearts (Sheherazade and Tsang 2015); some people in Jakarta, Surabaya, and North Sumatra, Indonesia (Sheherazade, unpublished

data); among villagers in Myanmar, who only consume bats found naturally dead on the ground (M. M. Aung, unpublished data); communities in Thailand (Suwannarong et al. 2020); and Mizos in Nagaland, India (Hilaluddin et al. 2005). Longpfurii in India also believe that consumption of bats cures diarrhea, body pain, and increases virility (Dovih 2015), while communities in Thailand consume bat meat or blood for muscle pain, increasing virility, and longevity (Suwannarong et al. 2020). Newars of Nepal believe that a tincture of bats (especially family Hipposideridae) soaked in oil can cure baldness and also ear infections caused by millipedes (Tuladhar-Douglas 2008).

Other traditional uses of bat parts include applying bat feces to cure eye disease, prescribed by the sixteenth century medicinal Chinese text *Compendium of Materia Medica* (Li and Luo 2003). Early twentieth century Malays in Kelantan, Peninsular Malaysia, reportedly prevented thievery by mixing flying fox blood with *buta-buta* (*Excoecaria agallocha*) tree sap to cause violent intestinal inflammation (Gimlette 1929). In Pakistan, the body fat of *P. giganteus* was made into massage oil to cure rheumatic pains, while drinking water from a bat's wing was said to sharpen one's memory (Mahmood-ul-Hassan et al. 2011).

Discussion

Our literature review provides clear evidence for a rich array of sociocultural representations of bats across the Asia-Pacific region. These diverse narratives contrast sharply with the predominantly negative perceptions dominating Western-influenced mass media and popular culture today, indicating that positive cultural perceptions of bats are not isolated or unique, but are rather under-represented in global, English-language narratives about bats. Additionally, our collective local knowledge helped correct and/or supplement information in the literature, underscoring the importance of local involvement and leadership in ethnobiological research, and the need for more locally spearheaded documentation efforts.

Many of these narratives represent historical cultural beliefs that may be rare amongst current generations and could disappear entirely (e.g., Fernández-Llamazares et al. 2018). Additionally, because these cultural expressions are closely tied to the communities' direct and embodied interactions with animals and their habitats, habitat loss and species extinctions are likely to impact communities' social memory and transmission of ethnobiological knowledge (Turvey et al. 2018; Wu and Petriello 2011). For example, the Iban flying fox rhyme is not sung to children born after the 1970s, who no longer experience the sight of flying foxes filling the sky, and lack the ethnobiological connection to the traditional rhyme (Gumal et al. 1998). As such, it is imperative to obtain more contemporary ethnobiological data to further our understanding about current attitudes and relationships with bats—and to document other cultural traditions not covered in this review.

The negative impact of such cultural erosion is compounded by contemporary negative messaging and scaremongering in the media that portray bats as disease carriers (López-Baucells et al. 2018; Tuttle 2018), thus conferring a negative value to bats. Given the powerful influence of English-language mass media in today's hyper-connected world, the damage such representations cause to bat conservation should not be underestimated (Schneeberger and Voigt 2016; Tuttle 2018). This has been made evident in the most recent scapegoating of bats amidst the COVID-19 pandemic (Rocha et al. 2020; Zhao 2020).

Issues affecting local attitudes towards bats in the Asia-Pacific region thus appear to be two-fold: the proliferating negative representations of bats due to growing Western influence and the simultaneous erosion of local biocultural memory and relation-

ships containing positive representations. As lived ontologies and epistemologies are grounded in the act of practice and active engagement, many cultural expressions may transcend a binary approach to symbolism-pragmatism (Ingold 2006). In these cases, the pragmatic dimension may outweigh symbolic frames and lead to seemingly contradictory customs and beliefs (Castelló and Capdevila 2013). Even cultures that value bats positively may have values conflicting with bat conservation, whereby the positive bat symbolism involves practices that could be unsustainable for bat populations. For example, Han Chinese attach positive aesthetic values to bats, but may still hunt bats at unsustainable levels (Epstein et al. 2009). Also, fruit growers may view fruit bats as crop pests (Aziz et al. 2016; Sinavaiana and Enright 1992). Therefore, using positive symbolism alone to promote bat conservation might be insufficient without accounting for day-to-day relationships of local communities with bats. Conversely, negative symbolism (e.g., as a taboo animal or associated with harm) could promote conservation if it prevents unsustainable hunting and consumption.

Bat conservationists in the Asia-Pacific region should attempt to first understand the culture they are targeting for conservation interventions, then use ethnobiological data to develop contextualized strategies for the various demographics of their target audience, leveraging on cultural values wherever possible (e.g., Bowen-Jones and Entwistle 2002). Mainstreaming and emphasizing the positive values of bats can serve as a useful component of outreach and awareness strategies. Efforts should be made to highlight and celebrate these culturally ingrained positive symbolisms, which could be used to construct positively framed messages, create a mere-exposure effect (Zajonc 2001), and even form the basis for conservation pride campaigns (Butler et al. 2013). Such an approach could potentially increase perceptual fluency and positive affect (Bornstein and D'Agostino 1994; Reber et al. 1998; Winkielman and Cacioppo 2001) in public perceptions of bats, whereby repeated exposure to an image can create familiarity and preference for it.

In situations where such cultural foundations are non-existent or lost, non-harmful utilitarian aspects based on bat ecosystem services (Kunz et al. 2011) may be helpful for short-term conservation action. One example is Southeast Asia's cultural affinity for the bat-pollinated durian (*Durio zibethinus*) fruit (Aziz et al. 2017b; Bumrungsri et al. 2009; Sheherazade et al. 2019). The durian features in creation myths of several Malaysian/Indigenous groups (Howell 1984; Rutter 1929), and even in Indigenous inheritance laws (Carey 1976). By highlighting both the economic and ecological importance of bat pollinators, it may be possible to raise public awareness and support for bat conservation, and persuade fruit growers to consider bats as allies (Sheherazade et al. 2019; Trejo-Salazar et al. 2016). Where durian may not be as relevant or when bats may have negative associations as crop raiders (Aziz et al. 2016, 2017a), one possible strategy could be to leverage on the tourism values of bats for providing a sustainable, long-term source of income for local livelihoods (Pennisi et al. 2004).

In contrast to the predominantly negative framings of bats as evil creatures in Western societies, the diverse cultures of the Asia-Pacific region possess a wide array of under-represented bat symbolisms that are positive. After centuries of Western demonization and recent sensationalized media coverage of bats solely as reservoirs of viruses—particularly in relation to the COVID-19 pandemic—bat conservationists today need to actively celebrate and revitalize positive sociocultural representations of bats to promote bat-friendly attitudes for conservation. Having a greater understanding of the cultural values, beliefs and practices of a community will help in devis-

ing and implementing effective conservation strategies across the Asia-Pacific region and elsewhere.

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