

Exploring Living Heritage Through Ethnozoology: Tribal Uses of Faunal Resources in West Bengal, India

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ABSTRACT

*Ethnozoology is an interdisciplinary field that examines the relationships between human cultures and the animal species with which they interact, focusing on their use, symbolism, and ecological roles within traditional knowledge systems. This review provides a comprehensive analysis of the roles animals play in human societies, emphasizing their medicinal, nutritional, religious, and economic importance. A total of 72 species were documented, with more than half primarily used for medicinal purposes, underscoring the crucial role of animals in ethnomedicine. The study reveals significant variation in how animals from different phyla are utilized. Simpler organisms such as earthworms and fish are mainly associated with medicinal uses, whereas more complex taxa including molluscs, amphibians, reptiles, birds, and mammals exhibit multifaceted roles spanning food, medicine, commerce, and religion. Mammals demonstrate the greatest diversity of usage patterns, playing key roles in both material subsistence and cultural traditions. The increasing commercialization of wildlife, particularly for body parts, raises conservation concerns for species such as *Gyps bengalensis* and *Manis crassicaudata*, both classified as Critically Endangered by the IUCN. The study advocates for integrated conservation strategies that balance cultural practices with ecological sustainability, highlighting the importance of community-based wildlife management and awareness programs. Additionally, the commercialization of high-demand species poses risks of overexploitation and population declines, emphasizing the need for sustainable harvesting practices and conservation-oriented management approaches.*

Keywords: ethnozoology; ethnomedicine; traditional knowledge; wildlife conservation; human–animal interactions

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1.INTRODUCTION

Ethnozoology examines the relationships between human societies and animal species, emphasizing their cultural, medicinal, nutritional, and economic roles within traditional knowledge systems. As a multidisciplinary field integrating zoology, anthropology, ecology, and ethnobiology, it explores how communities perceive, utilize, and manage animal resources in their daily lives. These interactions not only reflect cultural practices and belief systems but also contribute to broader ecological and conservation dynamics (Bennett & Prance, 2000; Alves et al., 2013). Throughout human history, animals have served multiple purposes including food, medicine, ritual practices, and tools. Traditional

knowledge systems often incorporate detailed ecological understanding of animal behaviour, habitat preferences, and biological properties. In many indigenous communities, such knowledge has been transmitted across generations and remains an important component of healthcare and cultural identity (Cunningham, 2001; Nabhan, 1993). However, increasing environmental degradation, habitat loss, and globalization threaten both biodiversity and the preservation of traditional ecological knowledge.

Ethnozoological practices are closely linked with biodiversity conservation. Cultural traditions sometimes promote sustainable use and protection of certain species; however, the growing commercialization of animal-derived products has increased pressure on wildlife populations. Such exploitation raises important ecological and ethical concerns, particularly when threatened species are involved (Alves & Souto, 2018). The complementary field of ethnoecology further highlights how indigenous ecological knowledge can contribute to community-based conservation strategies (Berkas, 2018). Within this context, zootherapy refers specifically to the use of animal-derived materials in traditional medical systems. Many ethnic and tribal communities employ animal products—including body parts, secretions, and derivatives—for the treatment of various ailments (Adeola, 1992; Alves & Souto, 2015). According to the World Health Organization, a large proportion of the global population continues to rely on traditional medicine, including animal-based remedies. Across regions such as Africa, Latin America, Asia, and Europe, diverse animal taxa are incorporated into therapeutic practices, sometimes involving species of conservation concern (Alves et al., 2012).

In India, ethnobiological research has historically focused more on medicinal plants, while studies addressing animal-based remedies remain comparatively limited. Nevertheless, several investigations have documented the therapeutic use of animals among indigenous communities across different regions of the country (Galav et al., 2013; Mandal & Rahaman, 2014). Similar practices have been reported among tribes in Nagaland, Tamil Nadu, and Kerala, where animals are used either independently or alongside plant-based treatments (Jamir & Lal, 2005; Kakati et al., 2006; Solavan et al., 2004; Padmanabhan & Sujana, 2008). In West Bengal, a number of localized studies have documented the ethnozoological practices of tribal communities. These include investigations among the Birhor community of Purulia (Chanda & Mukherjee, 2012; Chaudhury et al., 2016), inhabitants of the Darjeeling hills (Chhetri et al., 2020), the Mech tribe of Jalpaiguri (Sarkar et al., 2014), and communities in Burdwan and Birbhum (Mandal & Rahaman, 2022). Additional studies have highlighted the medicinal use of particular species such as *Oecophylla smaragdina* among indigenous groups in Jhargram (Mitra et al., 2020). Although these studies provide valuable insights, comprehensive syntheses of animal-use patterns across the region remain limited.

The present study consolidates and analyses existing ethnobiological literature documenting the use of animal taxa in West Bengal. Specifically, the study aims to:

1. Identify animal species used by indigenous communities.
2. Categorize their medicinal, nutritional, religious, and commercial roles.
3. Assess broader patterns of resource utilization and associated conservation concerns.

By synthesizing available information, this work contributes to a better understanding of the cultural and ecological significance of animals within traditional knowledge systems of the region.

2. METHODOLOGY

2.1 Study Area

West Bengal is located in eastern India and is bordered by Bangladesh to the east, Bhutan and Nepal to the north, and the Indian states of Sikkim, Assam, Bihar, Jharkhand, and Odisha. The southern boundary is marked by the Bay of Bengal. The state covers an area of approximately 88,752 km² and encompasses a diverse range of landscapes including Himalayan foothills, fertile alluvial plains, lateritic plateaus, and coastal ecosystems. This environmental diversity supports rich biological resources and a variety of cultural traditions.

According to the 2011 Census of India, Scheduled Tribes constitute approximately 5.8% of the total population of West Bengal (Dey, 2015; Bagchi, 2019). The state hosts 41 recognized tribal communities, many of which are distributed across the southern, western, and northern districts (Dey, 2015; Mandal & Chauhan, 2018). Among them, the Santals represent the largest group, followed by the Oraons, Mundas, Bhumijes, and Koras. Smaller communities such as the Lodhas, Birhor, Toto, Mahalis, Bhutias, and Bedias are also present in various regions.

For the present study, ethnobiological information associated with tribal communities inhabiting districts such as Darjeeling, Jalpaiguri, Birbhum, Burdwan, Purulia, and West Midnapore was compiled from previously published studies. These districts represent areas where ethnobiological research has documented traditional knowledge related to animal use (Fig. 1).

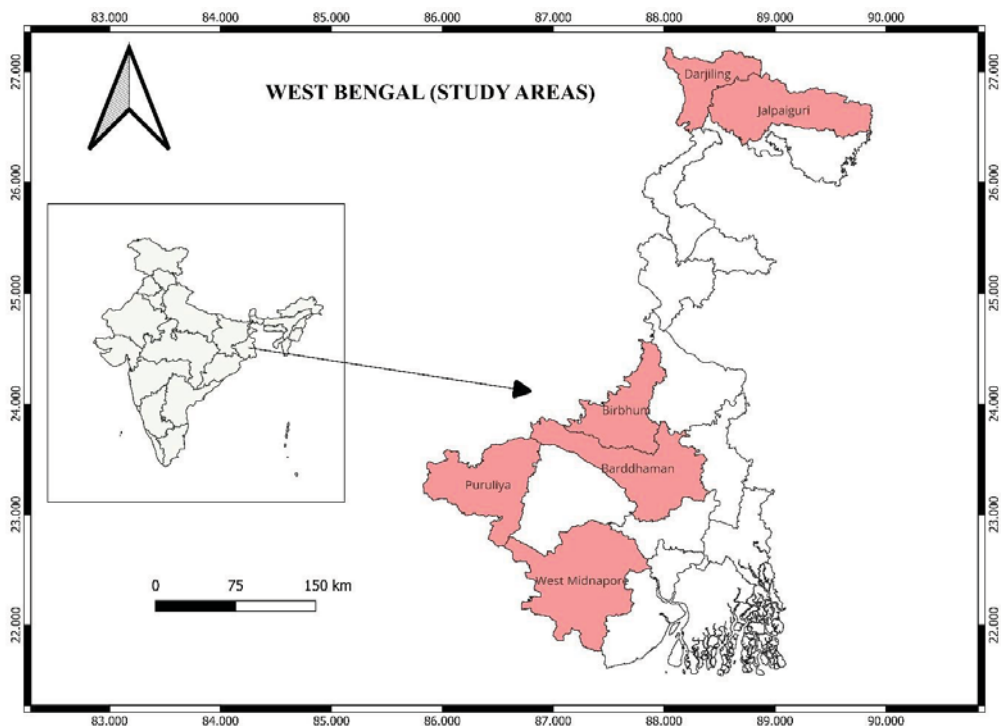


Figure 1. Study areas of different districts of West Bengal

2.2 Data Sources

A literature-based approach was employed to compile ethnobiological information regarding animal use among tribal communities of West Bengal. Peer-reviewed articles were collected through searches of academic databases including Google Scholar, PubMed, ResearchGate, and relevant scientific journals. Searches were conducted using combinations of keywords such as *ethnozoology*, *zootherapy*, *animal-based medicine*, *tribal communities*, and *West Bengal*.

Thirteen relevant studies reporting the use of vertebrate and invertebrate species in traditional practices were selected for analysis. These publications provided information on species identity, usage categories, anatomical derivatives used, and cultural contexts. The extracted data were organized and classified into different functional categories such as medicinal, nutritional, religious, and commercial use.

2.3 Applications Used

To visualize the relationships between animal taxa and their associated usage categories, bipartite curves were generated using R software. These graphical representations illustrate the connections between species groups and different utilization types. Additionally, geographic distribution of study locations referenced in the reviewed literature was mapped using QGIS software to illustrate the spatial coverage of ethnobiological studies included in the analysis.

3. RESULTS

A total of 72 animal species representing multiple taxonomic groups were documented as being used by indigenous communities for diverse cultural and utilitarian purposes (Table 1). These uses were classified into ten categories: medicine, food, food and medicine, food and commercial use, food medicine and commercial use, medicine and commercial use, medicine and religious use, commercial and religious use, religious use, and combined food medicine religious and commercial use.

Species Name	Common Name	IUCN Status	Part used
<i>Metaphire posthuma</i> (Vaillant, 1868)	Indian earth-worm (Kencho, Lendet)	Data Deficient (DD)	Whole body
<i>Pheretima posthuma</i> (Kinberg, 1867)	Kechua/ earthworm	Data Deficient (DD)	Whole body
<i>Aquarius remigis</i> (Say, 1832)	Nachni/ Da feria/Water strider	Least Concern (LC)	Whole body
<i>Apis sp.</i>	Khormosi/'Kathimodhu'/'Lottimachi'/'Honey Bee	Least Concern (LC)	Wax,Honey
<i>Oecophylla smaragdina</i> (Fabricius, 1775)	Red Ant	Least Concern (LC)	Whole body
<i>Heteropoda venatoria</i> (Linnaeus, 1758)	Manirema	Least Concern (LC)	Unknown
<i>Sartoriana spinigera</i> (Wood-Mason, 1871)	Wood mason,Khangkhrai	Data Deficient (DD)	Unknown
<i>Cancer pagurus</i> (Linnaeus, 1758)	Crab (Behula Kankra, Dhiri Katkom)	Least Concern (LC)	Unknown
<i>Cornu aspersum</i> (O. F. Müller, 1774)	Gugli/Snail	Least Concern (LC)	Flesh
<i>Crassostrea gigas</i> (Thunberg, 1793)	Jhajni/ Common oyster	Least Concern (LC)	Flesh and Shell

<i>Perna viridis</i> (Linnaeus, 1758)	Jhinuk or Chatni/Green mussel	Least Concern (LC)	Flesh
<i>Bellamya bengalensis</i> (Lamarck, 1822)	Gugli	Near Threatened (NT)	Whole body
<i>Lymnaea acuminata</i> (Lamarck, 1822)	Jinai Khong	Least Concern (LC)	Flesh
<i>Helix aspersa</i> (Müller, 1774)	Molluscs	Least Concern (LC)	Unknown
<i>Pila globosa</i> (Swainson, 1822)	Samu ladai	Least Concern (LC)	Unknown
<i>Crassostrea madrasensis</i> (Preston, 1916)	Gugli	Least Concern (LC)	Unknown
<i>Lamellidens marginalis</i> (Lamarck, 1819)	Freshwater mussel (Jhinuk)	Near Threatened (NT)	Shell
<i>Sperata aor</i> (Hamilton, 1822)	Long-whiskered catfish (Aar machh)	Least Concern (LC)	Parietal bone
<i>Chitala chitala</i> (Hamilton, 1822)	Clown knife fish (Chital haku)	Least Concern (LC)	Scale
<i>Monopterus albus</i> (Zuiew, 1793)	Mud Eel Bam machha	Least Concern (LC)	Whole body
<i>Euphlyctis hexadactylus</i> (Lesson, 1834)	Indian green frog (Jar-Baang, Badhe)	Least Concern (LC)	Body fat
<i>Nanorana liebigii</i> (Günther, 1860)	Liebig's Frog Maan paa	Least Concern (LC)	Whole body
<i>Hoplobatrachus tigerinus</i> (Daudin, 1802)	Choki/Frog	Least Concern (LC)	Flesh
<i>Duttaphrynus melanostictus</i> (Schneider, 1799)	Choki/Toad	Least Concern (LC)	Flesh
<i>Bungarus fasciatus</i> (Schneider, 1801)	Sakhamuti bin/Branded krait	Vulnerable (VU)	Flesh and poison
<i>Melanochelys trijuga</i> (Schweigger, 1812)	Horo/ Bengal Black Turtle	Vulnerable (VU)	Flesh and Shell
<i>Naja naja</i> (Laurenti, 1768)	Khorish Bing/Cobra	Least Concern (LC)	Poison
<i>Ptyas mucosa</i> (Linnaeus, 1758)	Dhamna bin/ Rat Snake	Least Concern (LC)	Skin
<i>Varanus bengalensis</i> (Daudin, 1802)	Goi/Bengal Monitor/Mai jethhi	Least Concern (LC)	Flesh and head
<i>Daboia russelii</i> (Shaw and Nodder, 1797)	Russell's viper (Chandrabora, Bing)	Least Concern (LC)	Body fat
<i>Lissemys punctata punctata</i> (Bonnaterre, 1789)	Turtle (Kachhop, Kachhim, Hara)	Vulnerable (VU)	Shell
<i>Python molurus</i> (Linnaeus, 1758)	Indian Python	Near Threatened (NT)	Body fat
<i>Indotyphlops braminus</i> (Daudin, 1803)	Brahminy Blind Snake	Least Concern (LC)	Unknown
<i>Columba livia</i> (Gmelin, 1789)	Paroa/ Pigeon/hagrani	Least Concern (LC)	Flesh
<i>Gallus gallus</i> (Linnaeus, 1758)	Kukri/Red jungle fowl	Least Concern (LC)	Raw egg and liver
<i>Metopidius indicus</i> (Latham, 1790)	Titir/ Bronze winged jacana	Least Concern (LC)	Flesh
<i>Oriolus xanthornus</i> (Linnaeus, 1758)	Gaphut Dauchen	Least Concern (LC)	Unknown

Anas platyrhynchos (Linnaeus, 1758)	Hang-sha	Least Concern (LC)	Unknown
Gyps bengalensis (Gmelin, 1788)	Vulture (Shakun, Gidi)	Critically Endangered (CR)	Bone
Halcyon smyrnensis (Linnaeus, 1758)	White-breasted kingfisher (Machh ranga, Kikir)	Least Concern (LC)	Skull & beak
Coracias benghalensis (Linnaeus, 1758)	Blue jay (Nilkantha)	Least Concern (LC)	Feather
Gallus gallus domesticus (Linnaeus, 1758)	Domestic fowl / Kukhra	Least Concern (LC)	Flesh Eggs Fats
Myophonus caeruleus (Linnaeus, 1766)	Blue Whistling Thrush / Kalchauda	Least Concern (LC)	Flesh
Passer domesticus (Linnaeus, 1758)	House sparrow Bhangera Garsakha	Least Concern (LC)	Flesh
Lophura leucomelanos (Linnaeus, 1758)	Kalij pheasant / Kaliz	Least Concern (LC)	Flesh
Treron phoenicoptera (Latham, 1790)	Harial/Yellow footed green pigeon	Least Concern (LC)	Flesh
Pavo cristatus (Linnaeus, 1758)	Marah/ Peacock	Least Concern (LC)	Feather and vocal cord
Axis porcinus (Zimmermann, 1780)	Jilu/ Deer	Least Concern (LC)	Horn,flesh and embryo
Bandicota bengalensis (Gray, 1835)	Guru/Rat	Least Concern (LC)	Flesh
Bos taurus indicus (Linnaeus, 1758)	Dangri/Cow	Least Concern (LC)	Skin, Fecal matter
Herpestes auropunctatus (Hodgson, 1836)	Neul/ Mongoose	Least Concern (LC)	Tooth
Hystrix indica (Kerr, 1792)	Sahi/ Porcupine,Dau mudai	Least Concern (LC)	Embryo and gastrointesti ne,Flesh Spine
Lepus nigricollis (F. Cuvier, 1823)	Kulhai/ Rabbit	Least Concern (LC)	Flesh and embryo
Manis crassicaudata (É. Geoffroy, 1803)	Sonamukhi or Bonrui/ Pangolin	Critically Endangered (CR)	Skin
Pteropus giganteus (Brünnich, 1782)	Badur/Bat	Least Concern (LC)	Flesh and feces
Sciurus carolinensis (Gmelin, 1788)	Kathbirali/ squirrel	Least Concern (LC)	Flesh
Semnopithecus entellus (Dufresne, 1797)	Haru/ Monkey	Least Concern (LC)	Flesh and skin, Blood
Sus scrofa domesticus (Erxleben, 1777)	Sukor/ Pig	Least Concern (LC)	Fat and jaw with teeth,Nose
Bos spp.	Goru and Gai	Least Concern (LC)	Flesh and tail Urine Milk
Equus asinus (Linnaeus, 1758)	Donkey / Gadha	Least Concern (LC)	Urine
Ovis aries (Linnaeus, 1758)	Sheep / Bheda	Least Concern (LC)	Ghee
Vulpes spp.	Fox / Syal	Least Concern (LC)	Flesh
Homo sapiens sapiens (Linnaeus, 1758)	Human / Manchay	Least Concern (LC)	Urine Milk

<i>Capra hircus</i> (Linnaeus, 1758)	Goat / Bakhra	Least Concern (LC)	Milk Urine Fecal matter
<i>Lepus spp.</i>	Hare / Kharayo	Least Concern (LC)	Brain Flesh
<i>Ursus thibetanus</i> (G. Cuvier, 1823)	Himalayan black bear / Bhalu	Vulnerable (VU)	Bile Gall bladder Fats
<i>Axis axis</i> (Erxleben, 1777)	Spotted Deer (Harin, Jil), Moi	Least Concern (LC)	Horn, Antler
<i>Canis familiaris</i> (Linnaeus, 1758)	Dog (Kukur, Sita)	Least Concern (LC)	Skull
<i>Cynopterus sphinx</i> (Vahl, 1797)	Short-nosed fruit bat (Chamchiki, Bhaulo)	Least Concern (LC)	Skull & wing bone
<i>Herpestes javanicus palustris</i> (Ghose, 1965)	Bengal mongoose (Beji, Chemench)	Least Concern (LC)	Naval chord
<i>Melursus ursinus</i> (Shaw, 1791)	Bear (Bhaluk, Bana)	Vulnerable (VU)	Teeth
<i>Myotis lucifugus</i> (LeConte, 1831)	Bah-dal	Least Concern (LC)	Unknown

Table 1. A list of all documented animal taxa, including the associated parts used, their common or local names as used by tribes, and their IUCN conservation status

3.1 Dominant Use Categories

Medicinal use constituted the most dominant category, with 39 species (54%) recorded exclusively for therapeutic purposes (Table 2). This highlights the continued reliance of tribal communities on traditional animal-based remedies for primary healthcare. The second most frequent category was food and medicine, representing 14 species (20%) of the recorded taxa. Species used solely as food accounted for 7 species (10%) of the dataset.

More complex usage combinations were relatively rare. Only two species (3%) were recorded under the food, medicine, and commercial use category. Other usage combinations, including food and commercial use, commercial and religious use, and food medicine religious and commercial use, were each represented by a single species (Fig. 2). These patterns indicate that most species are traditionally associated with specialized rather than multifunctional roles.

Use Categories	No. of Species	Percentage
Food & Coomercial Use	1	1
Commercial & Religious Use	1	1
Food, Medicine, Religious & Coomercial Use	1	1
Food, Medicine & Commercial Use	2	3
Religious Use	2	3
Medicine & Religious Use	2	3
Medicine & Commercial Use	3	4
Food	7	10
Food & Medicinal Use	14	20
Medicinal Use	39	54

Table 2. List of all the different categories of usage with associated species number and respective percentage of that use in the total use category

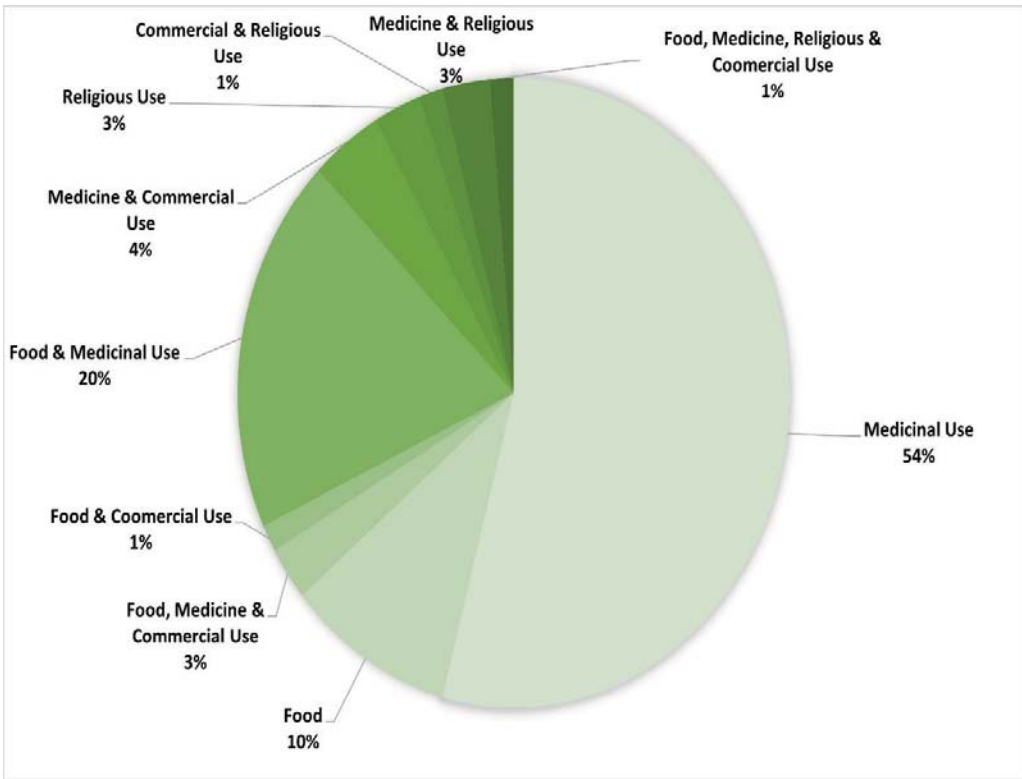


Figure 2. A pie chart depicting the percentage distribution of animal taxa according to different categories of usage.

3.2 Taxonomic Trends

Distinct utilization patterns were observed across taxonomic groups (Fig. 3). Mammals represented the most diverse group in terms of application and use combinations. Species within the genus *Bos* showed particularly broad utilization, contributing to food consumption, medicinal practices, religious rituals, and commercial activities.

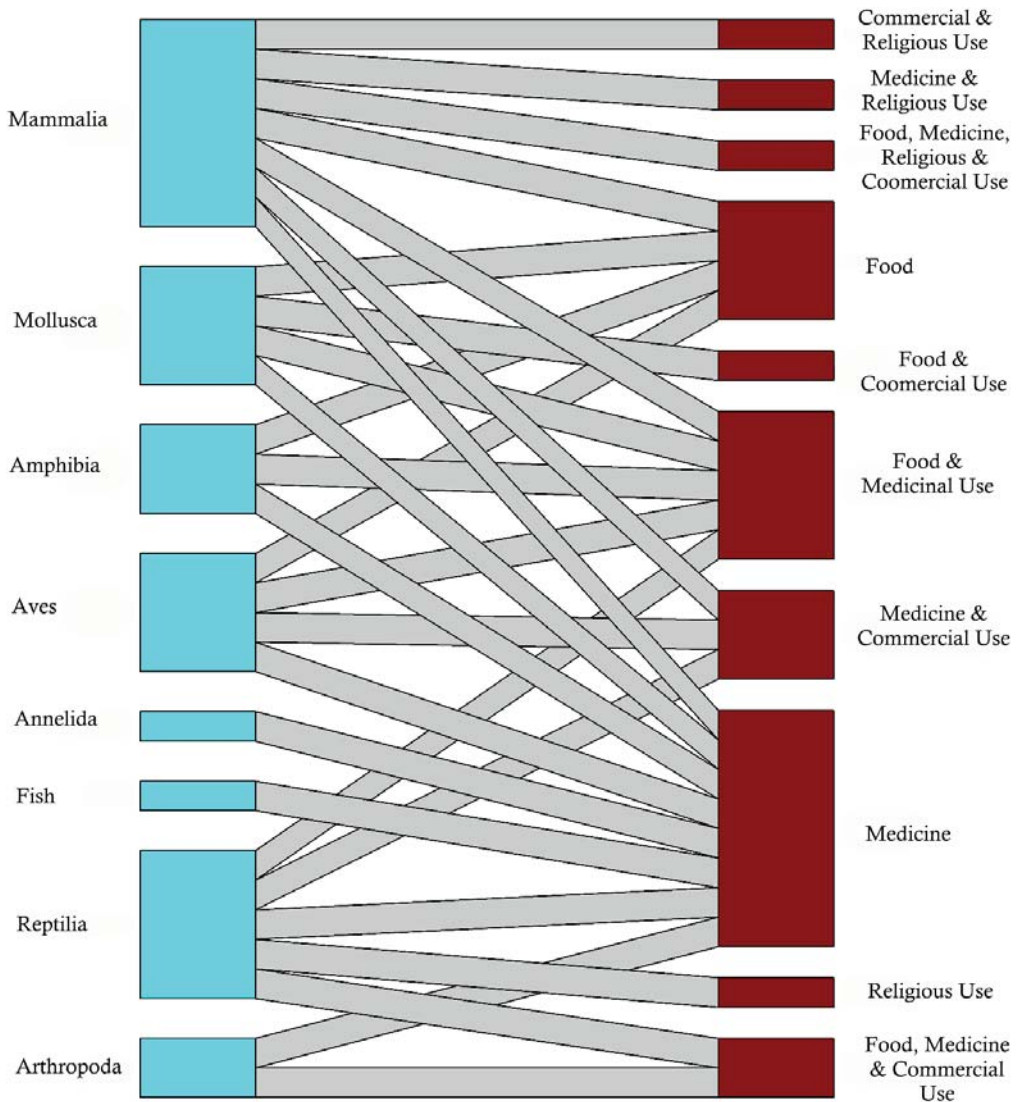


Figure 3. A bipartite curve representing the association between different animal phyla and various categories of usage.

Other mammals such as *Bos taurus indicus* were primarily associated with medicinal and commercial uses, whereas *Manis crassicaudata* was recorded in commercial and religious contexts. Several mammals including *Sus scrofa domesticus* and *Cynopterus sphinx* were frequently cited in medicinal treatments.

Bird species such as *Gallus gallus* and *Gallus gallus domesticus* were predominantly associated with medicinal applications, while *Pavo cristatus* displayed both medicinal and commercial importance (Fig. 4). Reptiles including *Naja naja* and *Varanus bengalensis* were also commonly associated with medicinal uses.

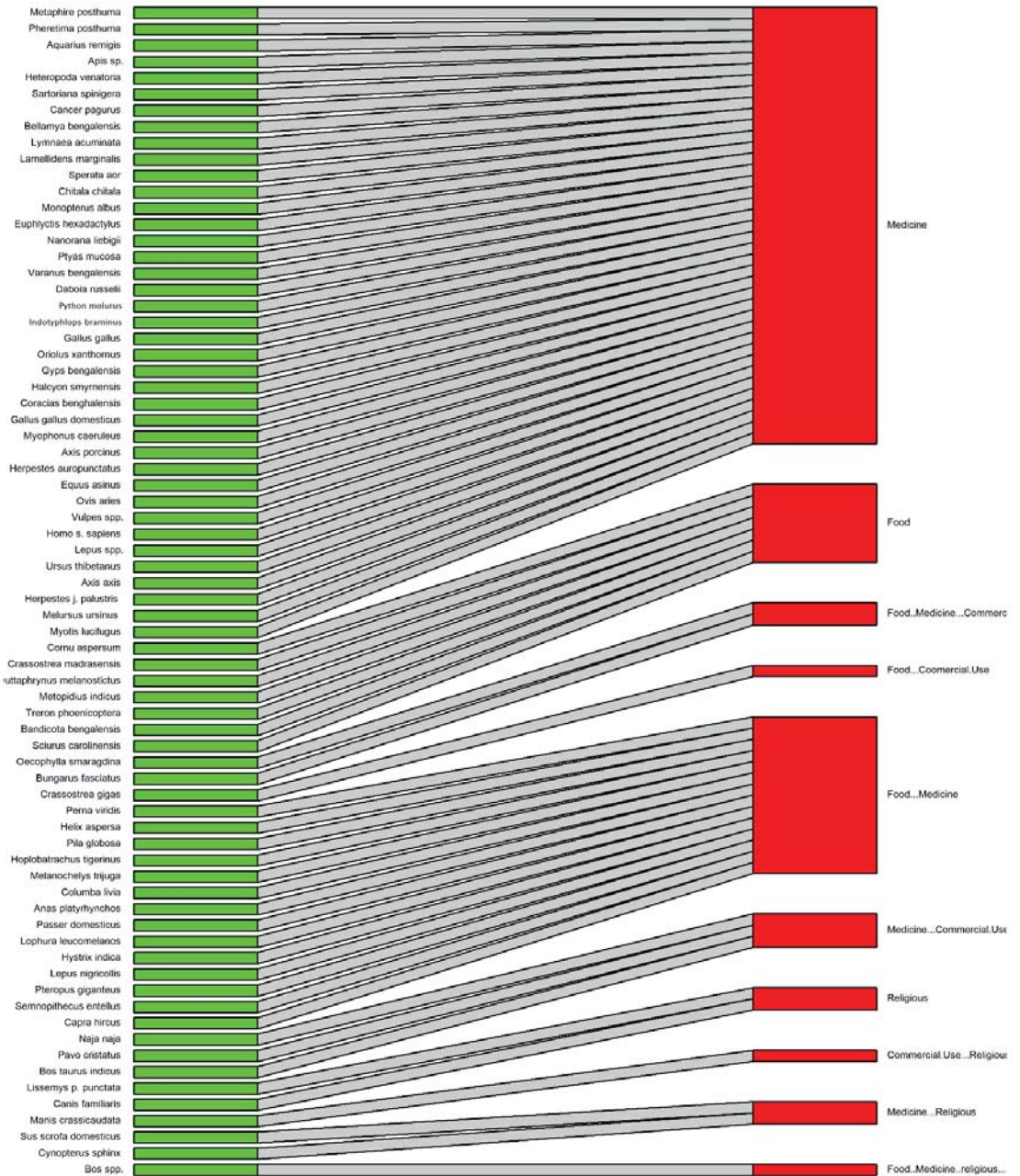


Figure 4. A bipartite curve representing the association between all the documented animal species and various categories of usage.

Amphibians and fishes, including *Monopterus albus* and *Chitala chitala*, were primarily utilized for both nutritional and medicinal purposes, without documented religious or commercial roles. Molluscan

species such as *Crassostrea gigas* and *Perna viridis* contributed mainly to food-based uses, although shell derivatives were also utilized for secondary purposes.

Among invertebrates, species such as *Apis* spp. and *Oecophylla smaragdina* displayed broader functional roles, serving as sources of food, medicinal substances, and commercial products.

3.3 Use Combinations

Multi-purpose use of species was relatively limited, suggesting that traditional knowledge systems often assign specific functional roles to particular taxa. Religious and commercial uses were primarily associated with larger vertebrates, including reptiles such as *Lissemys punctata punctata* and mammals including *Bos taurus indicus* and *Canis familiaris* (Fig. 4).

Only one species, *Bos* spp., was recorded under the most complex usage category encompassing food, medicine, religious, and commercial purposes. The wide use of domesticated animals reflects their accessibility, economic value, and cultural significance within tribal communities.

3.4 Relationship Between Usage and Anatomical Derivatives

A wide range of anatomical derivatives were utilized in traditional practices, including whole organisms, flesh, bones, shells, skin, fat, organs, secretions, and other structural components (Fig. 5). The type of body part used varied considerably among taxonomic groups and reflected differences in both dietary and medicinal applications.

3.5 Invertebrate Contributions

Among invertebrates, annelids such as *Metaphire posthuma* and *Pheretima posthuma* were primarily used in their entirety, indicating the importance of whole-body preparations in traditional remedies. Similarly, insects such as *Aquarius remigis* and *Oecophylla smaragdina* were often used as whole organisms for medicinal or nutritional purposes (Fig. 5). In contrast, species of *Apis* were valued for their secreted products, particularly honey and wax, which are widely used in traditional treatments and wound care (Fig. 5).

Molluscs also exhibited diverse patterns of anatomical utilization. Gastropods such as *Cornu aspersum* and *Lymnaea acuminata* were primarily consumed for their flesh, whereas bivalves including *Crassostrea gigas* and *Lamellidens marginalis* provided both edible tissues and shells used in agricultural or medicinal contexts. In some species such as *Bellamya bengalensis*, the whole organism was used in medicinal preparations (Fig. 5).

3.6 Vertebrate Contributions

Among vertebrates, fishes and amphibians were commonly used for edible tissues and body-derived substances. For instance, fishes such as *Sperata aor* and *Chitala chitala* provided specific anatomical components including bones and scales used in traditional treatments, while *Monopterus albus* was frequently used as a whole organism in medicinal preparations. Amphibians including *Nanorana liebigii* and *Hoplobatrachus tigerinus* were mainly utilized for flesh or whole-body preparations (Fig. 5).

Reptiles demonstrated a broader diversity of anatomical derivatives. Venom from snakes such as *Naja naja* and *Bungarus fasciatus* was collected for medicinal or commercial purposes. Other reptilian species such as *Varanus bengalensis* provided flesh, body fat, and head components used in traditional remedies, while turtles including *Melanochelys trijuga* and *Lissemys punctata punctata* contributed shell materials used in medicinal and ritual practices (Fig. 5).

Birds were mainly utilized for flesh, eggs, feathers, bones, and cranial elements. Species such as *Gallus gallus* and *Gallus gallus domesticus* provided eggs, liver, and body fat used in both dietary and medicinal contexts. Feathers from *Pavo cristatus* and skeletal elements such as skulls and beaks from species including *Halcyon smyrnensis* were also incorporated into traditional healing practices (Fig. 5).

Mammals exhibited the widest diversity of anatomical derivatives used in traditional practices. These included flesh, milk, fat, bones, horns, skin, urine, bile, embryos, and internal organs. Large mammals such as *Bos* spp. provided multiple derivatives including milk, urine, flesh, and tail components used in medicinal treatments and nutritional supplementation. Similarly, species such as *Sus scrofa domesticus* and *Ursus thibetanus* provided body fat used in therapeutic massage and treatment of musculoskeletal disorders (Fig. 5).

Other mammals including *Axis porcinus*, *Hystrix indica*, and *Semnopithecus entellus* provided horns, spines, embryos, blood, or gastrointestinal tissues that were incorporated into traditional medicinal preparations. The diversity of mammalian derivatives reflects their high cultural and medicinal significance in indigenous knowledge systems.

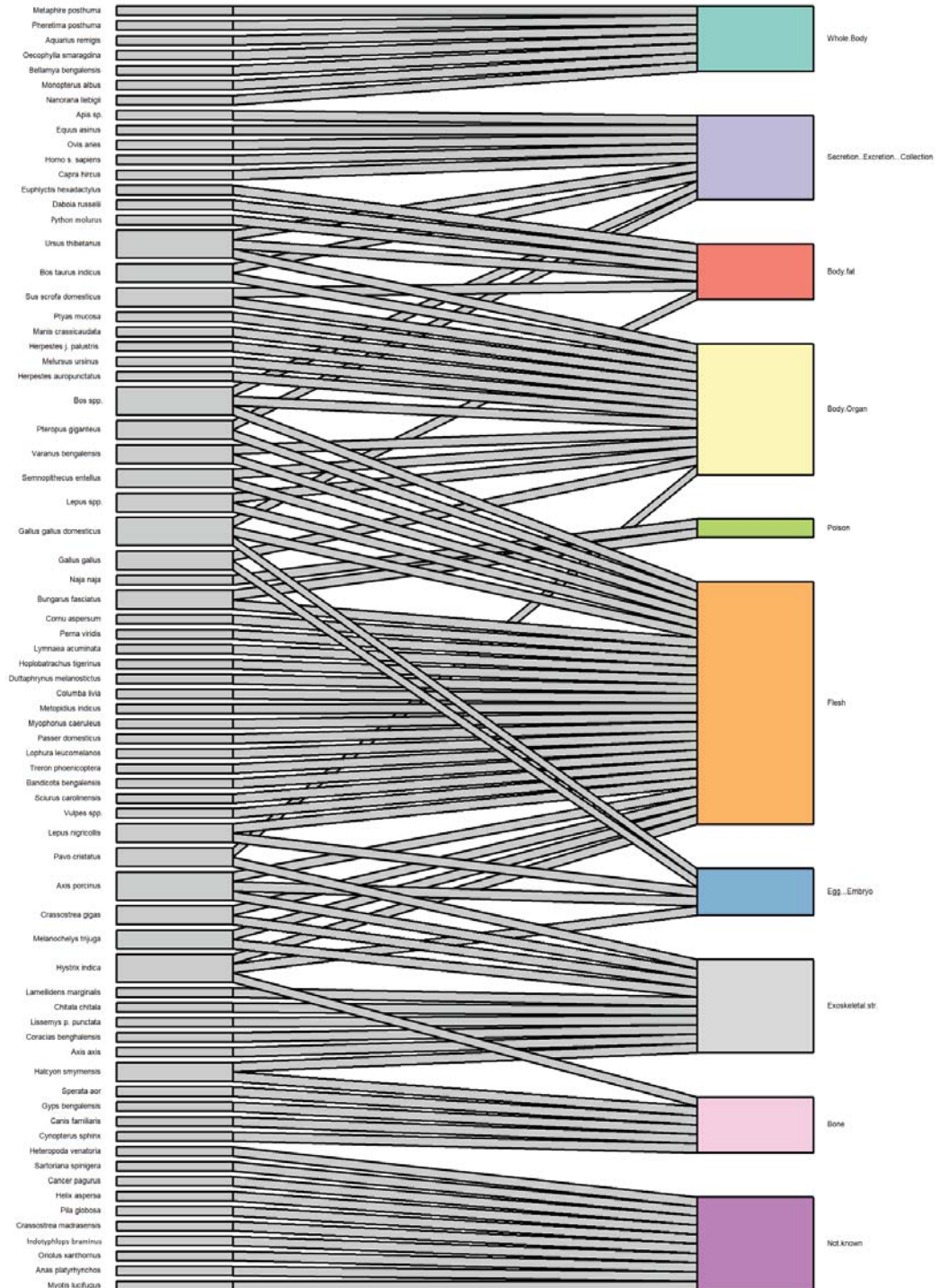


Figure 5. A bipartite curve depicting the relationship between documented animal species and the distinct anatomical structures or biological derivatives exploited for diverse anthropogenic applications.

4. DISCUSSION

The present study highlights the diverse roles animals play within traditional knowledge systems of West Bengal. The documentation of 72 species illustrates the breadth of ethnobiological interactions between indigenous communities and local fauna. The predominance of medicinal uses emphasizes the continued importance of animal-based remedies in traditional healthcare practices. Similar patterns have been reported in ethnobiological studies worldwide, where animal-derived materials constitute an important component of traditional medicine systems (Alves & Souto, 2015; Alves et al., 2012). Many of these remedies involve specific anatomical derivatives such as flesh, body fat, bones, shells, venom, and secretions, reflecting extensive traditional knowledge associated with the therapeutic value of different animal parts.

4.1 Variation Across Taxonomic Groups

Patterns of animal utilization varied considerably across taxonomic groups. Simpler organisms such as annelids and fishes were primarily associated with medicinal functions, likely reflecting their accessibility and ease of collection. Similar trends have been observed in other ethnobiological studies where easily accessible organisms form the basis of primary therapeutic resources (Adeola, 1992; Alves & Souto, 2015). In several cases, these organisms were used in their entirety, suggesting that whole-body preparations are common in traditional remedies.

In contrast, higher vertebrates including reptiles, birds, and mammals exhibited more complex patterns of use encompassing food, medicinal, religious, and commercial roles. Mammals in particular demonstrated the highest functional diversity, occupying several usage categories simultaneously. Species such as *Bos taurus* and *Sus scrofa domesticus* play central roles in both material subsistence and cultural traditions, reflecting their deep integration into human livelihoods. These mammals provide multiple anatomical derivatives including flesh, fat, milk, bones, and other body parts, which are used in dietary practices, medicinal treatments, and ritual activities. Such multifunctional utilization of mammals has also been reported in ethnobiological studies from various parts of Asia and Africa (Alves et al., 2013; Alves & Souto, 2018).

4.2 Multifunctionality and Cultural Significance

The multifunctional use of certain species underscores the complex relationships between humans and wildlife. Animals are not only sources of food and medicine but also hold symbolic, spiritual, and economic importance. Many medicinal practices rely on particular anatomical components such as fat, bones, feathers, venom, and shells, which are believed to possess therapeutic properties. The use of animal fats and oils, for instance, has frequently been documented in traditional medical systems for treating rheumatic conditions, muscular pain, and skin diseases (Adeola, 1992; Alves et al., 2012).

The documentation of *Manis crassicaudata* in both commercial and religious contexts illustrates how cultural practices may intersect with economic incentives. Similar patterns have been documented in other ethnobiological studies where species possessing cultural significance are simultaneously subjected to commercial demand (Alves & Souto, 2018). Reptiles and birds also contribute specialized

anatomical derivatives such as venom, feathers, and skeletal structures that are incorporated into traditional medicinal or ritual practices.

However, multifunctionality may also increase exploitation pressure. Species used across multiple domains and for multiple anatomical derivatives (Fig. 5) are likely to experience higher harvesting demand, potentially threatening their long-term survival. Previous studies have highlighted that multifunctional species are often subjected to higher levels of exploitation due to overlapping cultural, medicinal, and economic demands (Alves et al., 2012).

4.3 Conservation Implications

Several species documented in this study fall under threatened conservation categories. For instance, *Gyps bengalensis* and *Manis crassicaudata* are classified as Critically Endangered, while species such as *Ursus thibetanus*, *Melursus ursinus*, and *Bungarus fasciatus* are categorized as Vulnerable. The use of specific body parts such as bones, fat, venom, and skins for medicinal or cultural purposes may intensify harvesting pressure on these species.

Continued exploitation of these species for medicinal or commercial purposes could exacerbate population declines. Similar concerns have been raised in global studies examining the conservation implications of zootherapeutic practices (Alves & Souto, 2015; Alves et al., 2013). The demand for particular anatomical derivatives used in traditional medicine may further increase pressure on already vulnerable wildlife populations.

The documentation of traditional practices involving threatened fauna highlights the need for conservation strategies that integrate cultural perspectives. Sustainable management approaches must balance biodiversity protection with the preservation of indigenous knowledge systems. Ethnobiological research has increasingly emphasized the importance of integrating traditional ecological knowledge into conservation planning (Berkes, 2018).

4.4 Integrating Ethnozoology and Conservation

Ethnozoological research can contribute significantly to conservation planning by identifying culturally significant species and understanding how local communities interact with wildlife. The present study demonstrates that different animal body parts and derivatives (Fig. 5) are integrated into a wide range of traditional practices, including healthcare, nutrition, ritual activities, and economic exchanges.

Community-based conservation programs that incorporate traditional ecological knowledge may offer effective pathways for protecting biodiversity while respecting cultural practices. Previous research has shown that participatory conservation approaches involving indigenous communities can significantly improve conservation outcomes while maintaining cultural traditions (Berkes, 2018; Alves & Souto, 2018).

Future studies should focus on documenting lesser-known species, assessing the sustainability of harvesting practices, and evaluating the socio-economic drivers influencing wildlife use. Greater attention should also be given to understanding how the extraction and use of particular anatomical derivatives (Fig. 5) influence wildlife populations and ecosystem dynamics. Such research will be

essential for developing conservation policies that acknowledge both ecological and cultural dimensions of biodiversity use.

The findings of the present synthesis highlight the complex relationships between indigenous communities and animal biodiversity in West Bengal. The diversity of animal taxa and the wide range of anatomical derivatives utilized (Fig. 5) demonstrate the depth of traditional ecological knowledge embedded within local healthcare and subsistence systems. At the same time, the use of specific animal body parts such as flesh, fat, bones, venom, shells, and secretions illustrates how different biological materials are culturally perceived to possess therapeutic or symbolic properties. While such practices represent valuable components of traditional knowledge systems, the increasing demand for certain animal-derived products may pose potential threats to wildlife populations, particularly when species of conservation concern are involved. Therefore, integrating ethnobiological knowledge with conservation planning is essential to ensure sustainable use of faunal resources. Future research should emphasize community participation, documentation of traditional knowledge related to lesser-known species, and evaluation of sustainable harvesting practices to balance biodiversity conservation with the preservation of cultural heritage.

5. CONCLUSION

The present study provides a comprehensive overview of the ethnozoological knowledge associated with animal-based traditional practices among indigenous communities of West Bengal. A total of 72 animal species representing diverse taxonomic groups were documented, reflecting the extensive dependence of local communities on faunal resources for medicinal, nutritional, cultural, religious and commercial purposes. Among the recorded use categories, medicinal applications constituted the dominant form of utilization, emphasizing the continuing importance of zootherapeutic practices in traditional healthcare systems. The findings further revealed that mammals exhibited the highest diversity of use combinations and anatomical derivatives, while reptiles, birds, fishes, amphibians, molluscs and invertebrates contributed specialized biological materials including venom, shells, feathers, fats, bones, secretions and whole-body preparations.

The study demonstrates that traditional knowledge systems assign highly specific functional roles to different animal taxa and anatomical components. Species such as *Bos* spp., *Sus scrofa domesticus*, *Naja naja*, and *Apis* spp. were found to possess multifunctional significance, contributing simultaneously to medicinal, dietary, ritualistic and economic practices. The diversity of body parts utilized highlights the depth of indigenous ecological knowledge and the cultural perception of therapeutic properties associated with specific animal-derived materials. At the same time, the relatively limited occurrence of multifunctional use combinations suggests that many traditional practices remain taxon-specific and culturally specialized.

Importantly, the study also identifies significant conservation concerns associated with the continued utilization of threatened wildlife species. The documentation of Critically Endangered and Vulnerable taxa, including *Manis crassicaudata*, *Gyps bengalensis*, *Ursus thibetanus* and *Bungarus fasciatus*, indicates that harvesting pressure driven by medicinal, ritualistic and commercial demand may contribute to further population declines. These findings underscore the urgent need to integrate ethnobiological knowledge with biodiversity conservation strategies. Conservation planning should

therefore recognize the socio-cultural importance of animal-based traditional practices while simultaneously promoting sustainable harvesting approaches and species protection.

Overall, this study highlights the complex interconnections between indigenous communities and animal biodiversity in West Bengal and demonstrates the importance of ethnozoological research in understanding human–wildlife relationships. The generated documentation provides valuable baseline information for future studies on traditional medicine, wildlife utilization, and conservation biology. Integrating community participation, traditional ecological knowledge and sustainable resource management will be essential for balancing cultural heritage preservation with long-term biodiversity conservation.

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8. CONFLICT OF INTERESTS

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