

Iconic Fauna of Heritage Significance in India

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Abstract

There are many reasons why an animal becomes iconic in human cultures — admiration for certain qualities of the animal, its mere presence in or association with our environment, its utility to our endeavours, and fear of the creature that may even result in its worship. Given the equal status to all forms of life in ancient Indian religions, it is not surprising that “iconic fauna of heritage significance” in the country include not just the largest or fiercest animals (elephant, tiger and lion), but also a number of birds (peacock, eagle, vulture, sarus crane) and even insects (ant, honey bee, praying mantis). This essay traces the possible reasons for the iconic status and heritage significance of a representative set of mammals, birds, reptiles, fish, and insects. As this volume is devoted to a genomic view of India’s heritage species, I also provide a brief introduction to the evolutionary history and phylogenetics of most of these faunal taxa described here.

Key words: Animal-human relationship, Animal worship, Heritage animal, Indian culture, Phylogenetics, Religion

1. INTRODUCTION

The term ‘fauna’ refers collectively to all species of animals, from the largest mammal to tiniest insect that may be found in a certain location or region. Many animal species become ‘iconic’ in the context of its specific association with or significance to people. An iconic animal eventually attains “heritage” significance when its special status is indelibly inscribed in the folklore, literature, art, culture and even religion of a particular society.

It would be first useful to reflect upon why an animal becomes iconic in a societal context. Obviously, the relationship between people and animals has varied across human cultures, religions and regions, but this is a much understudied discipline (Hobson-West 2007). Ancient human societies compulsorily had a close interface with the natural world and its denizens, large and small. While the intensity of this human-

animal interaction has declined steeply in highly urbanized societies, this relationship still continues in a large number of societies that are still hunter-gatherer, pastoralist, agriculturalist, or even simply rural. The most obvious reason for an animal to become iconic is its conspicuous presence in the natural environment combined with human admiration for one or more of its qualities. Thus, the peacock’s colourful train of feathers, presumably beautiful not just to peahens but also to the human eye, would have endowed it with an iconic status in ancient Indian society. The mere association of an animal with humans would be another reason for conferring it iconic status. The first animal to be domesticated, the dog, eventually came to be known as ‘man’s best friend’ and this association has given it iconic status across cultures worldwide (Larson et al. 2012). The utility of an animal to human societies is another reason for its iconic status – the elephant, the cow and

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the horse are examples of this. Finally, an animal may be worshipped out of fear, with examples being a carnivore such as the tiger or a potentially harmful creature such as the cobra.

The described fauna of India includes 92,873 species of Kingdom Animalia, apart from about 3500 species of Kingdom Protista (records of Zoological Survey of India), while the undescribed or yet to be discovered species (especially arthropods) would certainly take this figure above half a million and perhaps closer to one million species. Given the equal status to all forms of life in ancient Indian religions, it is not surprising that “iconic fauna of heritage significance” in the country include not just the largest or fiercest animals such as the elephant and the tiger, but also insects such as ants, the honey bee and even the praying mantis. Iconic animals were identified closely with the gods in Hindu scriptures, the *Bodhisatva* in Buddhist literature, and with the *Tirthankaras* in Jainism. Given the large number of heritage fauna from diverse taxonomic groups, I shall dwell upon a few examples here, drawn mostly from the work of several people, in particular, Dr. Nanditha Krishna who has brought much of this together in her book on the sacred animals of India (Krishna 2010). As

this paper is part of the proceedings of a symposium on a genome view of our heritage fauna, I shall also provide references to the most recent work on this subject in the context of a taxon’s evolutionary history.

2. MAMMALIAN HERITAGE FAUNA

It is natural that many, if not most, of iconic fauna of heritage significance come from the class mammals of which humans are a part. While it can be argued that microbes have shaped human evolution (Blaser and Webb, 2014) to a far greater extent than have the larger, visible fauna, it is the mammals that humans have directly engaged with in their quest for food, clothing, guardian, a means of transport, and so on.

The Asian elephant (*Elephas maximus*) is arguably the foremost example of an iconic fauna that has shared an extremely complex relationship with people through history (Sukumar 2011) (Fig. 1). From being viewed merely as a source of food by hunter-gatherer societies through being captured for use as an instrument of war to its worship as a supreme god, the elephant is the ultimate iconic animal of heritage significance in any society worldwide in my opinion. This



Fig. 1. The Asian elephants — Mudumalai (left) and Kaziranga (right) tuskers are examples of close interactions with people through the centuries, also treated as iconic mammal. India declared the elephant as the National Heritage Animal in 2010. Courtesy: Karpagam Chelliah

complex relationship could only be enacted by a creature with highly advanced social organization plus superior levels of intelligence, cognition and behaviours suggestive of ‘theory of mind’ attributes (Vidya and Sukumar, 2005; de Silva et al., 2011).

The earliest proboscideans, the order to which elephants belong, date back to the Palaeocene, about 60 million years ago (Sukumar, 2003). The genus *Elephas* evolved in Africa, along with its elephant cousins (*Loxodonta* – the African elephant, and *Mammuthus* – the mammoth), about 7-6 million years ago (Maglio, 1973; Rohland et al., 2007) and migrated to Asia about 4 million years ago. The immediate ancestor of the modern Asian elephant is believed to be *E. hysudricus* whose fossils have been found in the subcontinent and neighbouring Myanmar. The emergence of *E. maximus* was shaped by evolutionary pressures operating during the strong glacial-interglacial cycles of the Pleistocene. Mitochondrial DNA analyses of *E. maximus* have thrown up two major clades that differentiated following isolation during one of the intense glacial periods, about 2.1 to 1.6 million years ago, in the ancestral *E. hysudricus* and still persist today (Vidya et al., 2009). A recent exercise in sequencing the entire genome and transcriptome (from blood lymphocytes) of the Asian elephant identified over 1500 genes, a large number related to olfaction, that differed from the corresponding loci in the African elephant, as well as 181 unique protein domains differing from their closest relatives in the superorder Afrotheria (Reddy et al., 2015).

There is little evidence that Palaeolithic hunter-gatherers actively hunted elephant, but rather scavenged on dead animals and extracted fat from bone marrow. It is generally accepted that the elephant was tamed by Harappan times. Several Harappan seals depict the elephant with what seems to be a cloth draped over its back but no rider. Even if this is not firm evidence of a tame

elephant, a terracotta figurine with colour bands on its forehead from Harappa dating to about 2200-1900 BC clearly indicates that tame elephants were known by this time (Sukumar, 2011).

The iconic status of the elephant can be first seen in the so-called Paśupati seal of Harappan culture, its sacred status in a rock engraving (*Gajatamé*) during Ashoka’s reign in Buddhist culture, and its eventual elevation to supreme godhead in the form of Gaṇeśa in Hindu India during the Kushan period (Sukumar, 2011). The enormous utility of an animal that was also to be feared for its potential to cause destruction to cultivated crops contributed to this process of cultural evolution. If the taming of the elephant can be traced to Harappan times, the deployment of the elephant as an instrument of war can be placed as early first millennium BC. The large scale capture and use of elephants in armies can be traced to the rise of kingdoms and empire in the Gangetic basin during the 4th century BC. The formidable war machine of the Mauryas included several thousand elephants. The Kautilya *Arthaśāstra* provides a detailed account of how elephants were to be protected in *gajavanas* (elephant forests), captured, trained and deployed in battle (Rangarajan 1992; Trautmann 2015). The Mauryan view of the elephant, that seemed entirely utilitarian during the reign of Chandragupta, changed to reverence for the animal during the time of his grandson Ashoka (Sukumar 2011). It was only by about the 4th or early 5th century AD that the elephant-headed GaṆeśa emerged in Hindu India (see papers in Brown, 1991). The elephant continued to be used in armies through the Mughal period, though its efficacy declined and the animal was eventually relegated to that of a baggage carrier. The direct utilitarian role of the elephant again came to the forefront during the British period when it became indispensable for logging the rich tropical forests to support the colonial expansion.

Over a 3000-year history the elephant played a major role in the rise and fall of kings, and shaped the nature of Asian civilizations (Trautmann, 2015). The launch of the conservation Project Elephant in 1992 helped stabilize and increase the numbers of wild elephants in India to its present level of about 30,000 individuals plus over 3000 in captivity. In 2010 the elephant was declared as the country's 'National Heritage Animal'.

The bovid family originated in Africa during early Miocene (Allard et al., 1992). Modern cattle have their origins in two domestication events of the bovid *Bos primigenius* (aurochs) in southwest Asia and south Asia that gave rise to *Bos taurus* (taurine cattle) and *Bos indicus* (zebu or humped cattle) about 10,000 – 8,000 years ago, though the mtDNA lineages of the ancestral aurochs may have diverged anywhere between 200,000 and 1 million years ago (Loftus et al., 1994; MacHugh et al., 1997; Achilli et al., 2009). Humped cattle appear on Harappan seals, though perhaps not as commonly as one would have expected. Śiva as Paśupati is the lord of all animals of which the cow is the most important. Reverence for the cow may have its origins in the utility of the creature to humans. Anthropologist Marvin Harris traces the origins of the sacred cow to benefit-cost equations of long-term utility to agriculture versus short term gain from slaughter for meat (Harris, 1966, 1978), though this theory is not without controversy (see, for instance, Diener et al., 1978). The utilitarian argument finds support in the *Yajur Veda* (13.49) which exhorts the king to never kill bullocks that are useful to agriculture and cows that give us milk, and to mete out punishment to those who harm these animals. The contemporary debates over cattle grazing in forests or ban on cow slaughter have to be seen in this historical light.

Herbivores such as the black buck (*Antelope cervicapra*) and the nilgāi (*Boselaphus tragocamelus*) have enjoyed legendary protection

of the Bishnois in northwestern India. This may be puzzling given that these animals depredate on cultivated crops, but the protection of these creatures and the *khejri* tree (*Prosopis cineraria*) characteristic of the area may be an age-old recognition of the need to preserve the harsh and fragile environment of the arid region (Srivastava, 2006).

India is home to many species of non-human primates (the recognised number is 13 species but this may change with molecular genetic studies). The term *vānara*, derived from *vana* (forest) and *nara* (man), is applied both to monkey and forest-dwelling tribes in the ancient epics (Krishna, 2010). Monkeys have traditionally enjoyed the protection of society; in most temple towns in the country the abundance of monkeys is attributed to protection and feeding by pilgrims (Krishna, 2010). The iconic monkey-god Hanuman of the *Rāmāyaṇa*, considered as “flawless” and “a perfect being”, is identified with the grey or Hanuman langur (*Semnopithecus entellus*) that is widespread across the subcontinent and Sri Lanka. While the earliest primates are 55 million years old, monkeys of Colobinae (that include the langurs) diverged from the Cercopithecinae about 23.5 million years ago during Early Miocene (Chatterjee et al., 2009). Nuclear genetic markers show that the genus *Semnopithecus* diverged from its closest colobine relative, *Trachypithecus*, about 2.56 million years ago during the Pliocene-Pleistocene transition (Roos et al., 2011). Langur monkeys live in matrilineal social groups exhibiting female natal philopatry (Newton and Dunbar, 1994). Recent molecular studies, characterising mtDNA (cytochrome b) and nuclear protamine P1 genes, have made a convincing case for at least three species of ‘*Hanumān langūr*’ – the Northern Type *Hanumān* from northern India, Southern Type *Hanumān* from southern India (south of rivers Tapti and Godavari), and Southern Type *Hanumān* from Sri Lanka (Karanth et al., 2010).

When it comes to carnivores, it is not surprising that the tiger (*Panthera tigris*), possibly the most feared of the predators, had also attained cult status in ancient times (Thapar 2002). Tiger folklore and ritual extends from the forests to Siberia through China, Indo-China and Indonesia to India. To forest dwellers across this vast landscape, the secretive and elusive tiger, superbly capable of stalking and killing them, was a creature with a human soul (Thapar 2002). It is the tiger and not the lion that is depicted in Harappan seals. The tiger is the mount of Durga, the destroyer of evil, across eastern India, and the vehicle of Ayyappa in southern India. Under various names such as *Waghoba* and *Waghya*, the tiger is a forest deity in central India. Various forms of the ritual tiger dance are performed in all the southern states as well as in Odisha.

As with many other mammal species, the evolutionary history of the tiger has been shaped considerably the glacial-interglacial cycles of the Pleistocene. The oldest tiger fossils are dated to about 2 million years BP from northern China and Java (Hemmer 1987). Mitochondrial DNA haplotype analyses indicate that the most recent common ancestor of the modern tiger is only 104,000 yr to 72,000 yr BP, much younger than other *Panthera* species (Luo 2004). Contrary to the conventional classification of the tiger into eight subspecies, the most recent genetic analyses of mtDNA, nuclear major histocompatibility complex gene, and nuclear microsatellite loci provide support for only six subspecies including the Bengal tiger *Panthera t. tigris* (Luo 2004). The tiger entered the Indian subcontinent only towards the end of the Pleistocene about 12,000 years BP.

The tiger has survived the vast destruction of India's forests and the relentless hunting for sport during the colonial period (Rangarajan, 2001). The latest country-wide estimate places the number at 2226 tigers (Jhala et al., 2015). Although the launch of Project Tiger in 1973 has undoubtedly contributed to the survival of an

animal whose persistence beyond the 20th century was doubted by many conservationists, the eventual success was because "millions of forest dwellers believed in the power of the tiger, preferring to fear and respect it rather than kill it" (Thapar, 2002).

It is however the lion (*Panthera leo*) that attained supreme iconic status as a royal symbol (Divyabhanusinh 2005). India's national emblem is the famous lion capital of the emperor Ashoka, interestingly crafted in Perso-Hellinistic style at Sarnath during the 3rd century BC. The lion is not represented in the seals of the Harappan culture, but lion symbolism came from Persia or further west and gained importance in the subcontinent during the second half of the 1st millennium BC (Divyabhanusinh, 2005). The symbolic association of the lion with two great teachers of the subcontinent, Mahāvīra and Gautama Buddha, is thus posthumous. Its ultimate status as "*mṛigarājā*" or the king of beasts could have been due to more than one reason. The lion was a "free agent waiting to be adopted" by the rulers of the subcontinent such as the Nandas and the Mauryas, inspired by their contacts with the great West Asian empires (Irvin quoted in Divyabhanusinh 2005). The lion was a social creature living in large prides, easily observable in open country (unlike the more secretive tiger in dense jungle that was to be feared), that lend itself to being admired and sought after as a symbol of strength and royal power.

There is some controversy as to whether the lion is native to India or came into the subcontinent through human importation only around the time of Alexander's invasion in 326 BC (Thapar et al. 2013). Lion fossils from the Pliocene and Pleistocene have been described in the subcontinent (see Divyabhanusinh and Ranjitsinh, 2013) but such evidence is questionable due to difficulties in differentiating lion bones from those of other *Panthera* species. The genetic evidence, however, seems to

unequivocally support the ancient presence of lions in the subcontinent (O'Brien, 2013). The modern lion originated about 250,000 years BP in Africa, whereas the Gir lion has been separated from the present-day lions of Africa for at least 100,000 years suggesting an ancient colonization of the subcontinent combined perhaps with a scattered presence over time (O'Brien, 2013).

3. AVIAN HERITAGE FAUNA

Many birds, especially beautiful (peacock), intelligent (crow – vehicle of Śani), or powerful, (eagle – Garuda; vulture – Jatāyu, Sampati) attained cult and, thereby, heritage status since ancient times.

The national bird of India, the peacock (*Pavo cristatus*) is undoubtedly the most iconic heritage bird of the country and, interestingly, the icon worldwide of the evolutionary theory of sexual selection. The co-founder of evolutionary theory, Charles Darwin, famously wrote to the noted American botanist Asa Gray in 1860 that “The sight of a feather in a peacock’s tail, whenever I gaze at it, makes me sick” (<https://www.darwinproject.ac.uk/letter/entry-2743>), because this seemingly maladaptive, though beautiful, trait did not fit into his theory of natural selection. Amotz Zahavi’s ‘handicap principle’ later provided a radically different perspective on

such elaborate male displays in the animal world (Zahavi, 1975; Zahavi and Zahavi, 1997); also see Raghavendra Gadagkar, this volume). Peafowl are pheasants from the order Galliformes whose origins go back to the Cretaceous period with rapid evolutionary radiations, though there are still many uncertainties regarding phylogenetic relationships among various families and genera (Kimball et al., 1999; Wang et al., 2013). Peafowl are a classic example of the lek mating system in which a number of males arrive at a location, call out to females and, when the latter arrive, indulge in spectacular displays with their tail feathers (technically, the upper tail coverts) to attract their attention for reproduction.

Once common across the drier regions of the subcontinent, including deciduous forest, cultivation and settlement, the peacock is deeply engrained in temple art, literature, and folklore of Hindu, Buddhist and Jain cultures (Nair, 1974). The Mauryas under Chandragupta, who established the first empire in the subcontinent during the 4th century BC, drew their clan name from the peacock (Krishna 20110). The peacock is the vehicle of Kārtikeya, also known as Skanda, Muruga and Subramania. Dravidians worshipped the peacock as Mother Earth, and Muruga or Subramania was the deified peacock. Around the 7th century AD, the Aryan war-god Skanda came

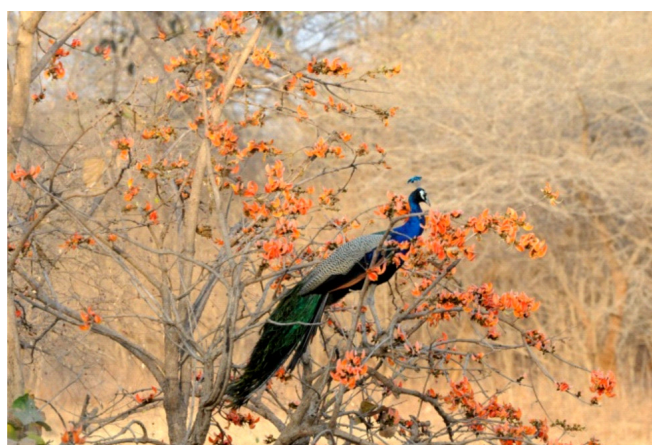


Fig. 2. The peacock, India’s National Bird, is an icon of evolutionary sexual selection, first enunciated by Charles Darwin. Courtesy: Raman Sukumar

to be identified with the Dravidian Muruga, thereby promoting a fusion of Āryan and Dravidian cultures (Nair 1974). The famous Sanskrit poet Kālidāsa's *Ritu Samhāra* describes the peacock's life through six seasons and its joy at the arrival of the rains (Krishna, 20110).

I must make a special mention of the iconic sarus crane (*Grus antigone*) that is much celebrated in Sanskrit literature. In the first book of the *Rāmāyaṇa*, the *Bālakāṇḍa*, Vālmikī witnesses the killing of the male *kraunca* bird by a hunter, whereupon the distress call of the female profoundly affects him (Vālmikī then goes on to pronounce a course on the hunter). There had been much speculation on the identity of the *kraunca*. A scholarly article by Julia Leslie firmly established this to be the sarus crane (Leslie, 1998), but the naturalist M. Krishnan had already identified this bird correctly in an essay several decades earlier (Krishnan, 1955). The sarus is identified with marital fidelity and the mention of this bird in the second chapter of the *Rāmāyaṇa* sets the stage for Vālmikī's narration of the epic story of the life and tragedy of Rāma and Sītā.

The term "sarus" may be derived from the Sanskrit "sārasa" meaning pertaining to lake or water, while the Tamil meaning of this word relates to dance (Sundar, 2003). Both these descriptors are very apt indeed. Described as the world's tallest flying bird (with males reaching up to 1.8 m height), this elegant bird inhabits marshes, cultivated land with standing water as in paddy fields, *jhīls* and other wetlands. The bird's pair-bonding and spectacular courtship dance ritual has been recorded by many naturalists. The Mughal emperor Jahangir wrote a detailed account of his observations of a pair of sarus cranes in his memoirs, *The Jahāngīrnāmā*; he reasoned that "Many strange and wonderful tales have been heard concerning the affection and attachment sareses have for their mates. Since they have been heard so often and are so strange, they are worth recording." (Thackston, 1999). The sarus crane is

today considered as "Vulnerable" in the IUCN Red List as the total population of the three extant subspecies of *G. antigone* is believed to be only 15,000-20,000 birds (Archibald et al. 2003). The taxonomic separation of this bird into three subspecies based on morphology, however, does not seem to be supported by the more recent DNA studies of mitochondrial haplotypes and nuclear microsatellites that indicate no long-term separation of populations across continental Asia, while Australia was colonised only about 35,000 years ago during the Late Pleistocene (Wood and Krajewski, 1996; Jones 2005). Cranes are also celebrated in Tibetan Buddhism.

Many other birds, especially birds of prey such as eagles and kites or scavengers such as the Old World vultures (all three groups from the family *Accipitridae*), also enjoy iconic status in Indian culture. As Nanditha Krishna states 'the visual appeal of a huge bird flying toward the sun.....the total fearlessness.....as they catch their prey – poisonous snakes or small mammals – added to their mystique [and] objects of admiration' (Krishna 2010). From ancient writings or folklore it is often difficult to identify the precise species of bird being referred to (Krishna 2010). Garuda, the vehicle of Vishnu, is believed to be the eagle (which eagle?) but could it also be a brahminy kite (*Haliastur indus*)? The eagle appears on a rhomboid Harappan seal suggesting an ancient iconic status in the subcontinent. This bird is also one of the most iconic of birds worldwide.

In the *Rāmāyaṇa* it is Jatāyu, "king of the vultures" (in this instance, believed to be the Oriental white-backed vulture (also known as white-rumped vulture), *Gyps bengalensis*, see Krishna 2010), that attacks Rāvaṇa when he kidnaps Sītā from the Panòcavatī forest, in the process suffering the loss of its wings. A catastrophic decline of *Gyps bengalensis* and other vultures occurred in recent times in the subcontinent, with over 99% reduction in the

population of *G. bengalensis* recorded between 1991-93 and 2007 (Prakash et al. 2003, 2013) that is now clearly attributable to poisoning through livestock carcasses by the use of the veterinary anti-inflammatory drug Diclofenac (Green et al. 2004). A bird once described as ‘possibly the most abundant large bird of prey in the world by Birdlife International (<http://www.birdlife.org/datazone/speciesfactsheet.php?id=3374>) and an enduring icon across south and southeast Asia of *Rāmāyaṇa* fame, became a critically endangered species virtually overnight. Since the ban on the use of Diclofenac, there has been a slowdown in the rate of decline of this bird though recovery to a safe level is still a long way off (Prakash et al. 2013).

Detailed phylogenies of the Accipitridae based on mtDNA and nuclear genes are now available that suggest somewhat different relationships among various groups as compared to those from morphology and life history (Lerner and Mindel, 2005).

The species-rich corvids (crows, rooks and ravens of the genus *Corvus*) are believed to have originated in the Australasian continent during the Tertiary, and radiated into southeast Asia after the mid-Miocene, eventually occupying all continents except for South America and Antarctica. A detailed molecular phylogeny is available for this group (Haring et al. 2012). The corvids are now considered to be not only among the most intelligent of birds, but have tool making and cognitive abilities that rank on par with some nonhuman primates (Bird and Emery 2009, Holzhaider et al. 2010). Ironically, the common crow (*C. splendens*) is one of the few creatures (the others being fruit bats, rats and mice) classified as “vermin” in India’s Wild Life Protection Act (1972) and can be exterminated freely (there are recent moves to remove this anomaly). Given the religious identification of crows with departed souls or ancestors, the crow, in fact, is not killed but worshipped! During the *śrāddha* or ancestor worship ceremony, food or

pinda is offered to crows. At the same time, the crow is also the vehicle of Shani (the Saturn god) and associated with evil or back luck. In Buddhism, the Dharmapāla (protector of the dharma) is identified with the crow.

4. OTHER HERITAGE FAUNA

The fear factor is obvious in the widespread worship of snakes, especially the cobra, across the subcontinent. As Dr. Krishna states about the cobra: ‘Its spectacled hood suggests a divine origin, while its secret life in dark holes under the ground has spun exotic stories’ (Krishna 2010). The cult of the snake had its origins among the non-Vedic people of the subcontinent. The *Nāgās* were snake worshippers and came to be identified with the creature itself. The *nāgā* cult is widespread from Kashmir to the northeast to the south of the country. The *nāgā* is associated with all major Hindu deities – Śiva, Viṣṇu, Gaṇeṣa and even Durga. Kṛṣṇa’s *kāliyā mardānam* may refer to a poisonous water snake.

Although all Asiatic cobras were once considered to be a single *Naja naja* species complex, the more recent morphological and genetic analyses have come up with support for 10 distinct species (Wüster, 1996). Mitochondrial DNA analyses have also show that the Asiatic *Naja* are monophyletic and derived from a single colonisation event from Africa, over 16 million years ago during the Miocene (Wüster 2007). While *N. naja* is the most common and widespread species across India, at least two other species, *N. oxiana* and *N. kauthia*, are seen in the northwest and northeast, respectively.

The *Matsya* (fish) *avatār* of Viṣṇu in the Purānas ensured iconic status to the lowest of the vertebrate forms. At Bet Dwaraka in Gujarat, the Shankodara temple is dedicated to *matsya*. Meenakshi is the fish-eyed goddess of Madurai, while many dynasties in the south such as the Pāṇḍyās and Vijayanagara chose the fish as their royal emblem.

Iconic status of fauna extends down to several insects (Kṛṣṇa 2010). Pārṇvati is believed to have taken birth as the bumblebee (giving her the name *bhramarambika*) in order to be close to Shiva who resides in the Srigiri hill in the form of a jasmine; thus the insect is revered at the Shaktipeetam at Srisailam. The honey bee has been celebrated in many ways – Kṛṣṇa is also called Mādhava (born of honey), Kama’s bow is made of sugar cane with a string of honey bees, while contemporary indigenous tribes such as the Jenu Kurubas of the south revere the insect that provides them a source of nourishment. The *vaid*s or medicine men of the Gonds of Vidarbha keep a praying mantis as pet and apparently even worship the creature.

5. CONCLUSIONS

The nature of the human-animal relationship is an essential element of the culture of any society. Such a relationship has evolved over a long period depending on the specific circumstances and the environment in which human societies have settled and conducted their day-to-day affairs. The significance of an animal in culture is based not merely on its presence but on keen observations of its habits and behaviours. Who would have thought that the crow considered as a nuisance in urban society and relegated to the legal status of a “vermin” would enjoy sacred status in our traditions; this is surely based on at least a modicum of ancient appreciation of its high levels of intelligence. It could also be argued that such “traditional ecological knowledge” as the concept of sacred spaces, sacred plants and sacred animals would have had adaptive value in ancient human societies (Gadgil et al., 1993, Berkes et al. 1995). While human-animal relationships are characteristic of all societies, it is perhaps in India that they find the fullest expression in religion, culture and everyday life, contributing eventually to the survival and persistence of the largest and fiercest creatures into the present time.

BIBLIOGRAPHY

- Achilli, A; Bonfiglio, S; Olivieri, A; Malusa, A; Pala, M et al. (2009) The multifaceted origin of taurine cattle reflected by the mitochondrial genome. *PLoS ONE* 4(6): e5753. doi:10.1371/journal.pone.0005753.
- Allard, M.W.; Miyamoto, M.M.; Jarecki, L.; Kraus, F. and Tennant, M.R.. DNA systematic and evolution of the artiodactyl family Bovidae. *Proc. Natl. Acad. Sci. USA* 89: (1992):3972-3976.
- Archibald, G.W; Sundar, K.S.G. and Barzen, J. A review of the three subspecies of sarus cranes *Grus antigone*. *Journal of Ecological Society* 16 (2003):5-15.
- Berkes, F., Folke, C. and Gadgil, M.. Traditional ecological knowledge, biodiversity, resilience, and sustainability. In: C.A. Perrings et al. (eds.) Biodiversity conservation. Kluwer Academic, AA Dordrecht, the Netherlands, 1995
- Bird, C.D. and Emery, N.J.. Insightful problem solving and creative tool modification by captive nontool-using rooks. *Proc. National Acad. Sci. (USA)* 106(2009):10370–10375.
- Brown, R. (ed.). *Ganesh: studies of an Asian god*. State University of New York Press, Albany, N.Y., U.S.A. 1991
- Chatterjee, H.J., Ho, S.Y.W., Barnes, I. and Groves, C.. Estimating the phylogeny and divergence times of primates using a supermatrix approach. *BMC Evolutionary Biology* 9 (2009):259, doi:10.1186/1471-2148-9-259
- Darwin, C. *The descent of man and selection in relation to sex*. John Murray, London. de Silva, S., Ranjeewa, A.D.G. and Kryazhinskiy, S. 2011. The dynamics of social networks among female Asian elephants. *BMC Ecology* 11(1871): 17.
- Diener, P., Nonini, D. and Robkin, E.E.. The dialectics of the sacred cow: ecological adaptation versus political appropriation in the origins of India’s cattle complex. *Dialectical Anthropology* 3 (1978):221-241.
- Divyabhanusinh. *The Story of Asia’s Lions*. Marg Publications, Mumbai. 2005
- Divyabhanusinh and Ranjitsinh, M.K.. Lion and Cheetah in India: The reality. A Critique. *J. Bombay Nat. Hist. Soc.* 110 (2013):3–21.
- Gadgil, M., Berkes, F. and Folke, C.. Indigenous knowledge for biodiversity conservation. *Ambio* 22 (1993)151-156.

- Green, R.E.; Newton, I.; Shultz, S., et al.. Diclofenac poisoning as a cause of vulture population declines across the Indian subcontinent. *Journal of Applied Ecology* 41(2004):793–800.
- Haring, E., Däubel, B., Pinsker, W., Kryukov, A. and Gamauf, A.. Genetic divergences and intraspecific variation in corvids of the genus *Corvus* (Aves: Passeriformes: Corvidae) – a first survey based on museum specimens. *J. Zool. Syst. Evol. Res.* 2012, doi: 10.1111/j.1439-0469.2012.00664.x
- Harris, M.. The cultural ecology of India's sacred cattle. *Current Anthropology* 7 (1966):51-66.
- Harris, M. *Cannibals and kings: the origins of culture*. Random House, New York, U.S.A., 1977
- Hemmer, H. The phylogeny of the tiger (*Panthera tigris*). In: Tilson, R.L. and Seal, U.S. (eds.) *Tigers of the world: The biology, biopolitics, management and conservation of an endangered species*. Noyes Publications, Park Ridge, N.J., U.S.A., 1987
- Hobson-West, P. Beasts and boundaries: an introduction to animals in sociology, science and society. *Qualitative Sociology Review* 3 (2007):23-41.
- Holzhaider, J.C.; Hunt, G.R. and Gray, R.D.. Social learning in New Caledonian crows. *Learning & Behavior* 38 (2010):206-219
- Jhala, Y.V.; Qureshi, Q. and Gopal, R. (eds.) *The status of tigers in India 2014*. National Tiger Conservation Authority, New Delhi, and Wildlife Institute of India, Dehradun. 2015
- Jones, K.; Barzen, K.L.; and Ashley, M.V.. Geographical partitioning of microsatellite variation in the sarus crane. *Animal Conservation* 8 (2005):1-8.
- Karanth, K.P., Singh, L. and Stewart, C-B.. Mitochondrial and nuclear markers suggest Hanuman langur (Primates: Colobinae) polyphyly: implications for their species status. *Molecular Phylogenetics and Evolution* 54(2010):627–633
- Kimball, R.T.; Braun, E.L.; Zwartjes, P.W.; Crowe, T.M. and Ligon, J.D.. A molecular phylogeny of the pheasants and partridges suggests that these lineages are not monophyletic. *Molecular Phylogenetics and Evolution* 11(1999):38–54.
- Krishnan, M.. Fabular fauna. (This article was first published in The Statesman newspaper and was reprinted in *Nature's Spokesman: M. Krishnan and Indian Wildlife* (Ed. Ramachandra Guha), Oxford University Press, New Delhi, 1955
- Lerner, H.R.L. and Mindell, D.P. Phylogeny of eagles, Old World vultures, and other Accipitridae based on nuclear and mitochondrial DNA. *Molecular Phylogenetics and Evolution* 37(2005):327–346.
- Newton, P.N. and Dunbar, R.I.M.. Colobine monkey society. In: Davies, A.G., Oates, J.F. (Eds.) *Colobine monkeys: their ecology, behaviour and evolution*. Cambridge University Press, Cambridge, U.K., 1994
- Larson, G., Karlsson, E.K., Perri, A. et al. 2012. Rethinking dog domestication by integrating genetics, archaeology, and biogeography. *Proc. National Acad. Sci. USA* 109: 8878-8883.
- Leslie, J. A bird bereaved: the identity and significance of Valmiki's *krāunca*. *Journal of Indian Philosophy* 26 (1998):455-487.
- Loftus, R.T.; MacHugh, D.E.; Bradley, D.G.; Sharp, P.M. and Cunningham, P. Evidence for two independent domestications of cattle. *Proc. National Acad. Sci. USA* 91(1994):2757-2761.
- Luo, SJ; Kim, JH; Johnson, WE; van der Walt, J; Martenson, J et al. Phylogeography and genetic ancestry of tigers (*Panthera tigris*). *PLoS Biol* 2.12 (2004): e442.
- Nair, P.T. The peacock cult in Asia. *Asian Folklore Studies* 33 (1974): 93-170.
- O'Brien, S.J.. The “exotic aliens” controversy: a view from afar. *J. Bombay Nat. Hist. Soc.* 110(2013):108-113.
- Prakash, V., Bishwakarma, M.C., Chaudhary, A., Cuthbert, R., Dave, R., et al.. The population decline of Gyps vultures in India and Nepal has slowed since veterinary use of Diclofenac was banned. *PLoS ONE* 7.11 (2012):e49118. doi:10.1371/journal.pone.0049118.
- Rangarajan, M.. *India's wildlife history: an introduction*. Permanent Black, New Delhi, 2001
- Rangarajan, L.N. *Kautilya: The Arthaśāstra* (edited and translated). Penguin Books, New Delhi, 1992
- Reddy, P.C., Sinha, I., Kelkar, A., Habib, F., Pradhan, S.J., Sukumar, R. and Galande, S.. Comparative sequence analyses of genome and transcriptome reveal novel transcripts and variants in the Asian elephant *Elephas maximus*. *J. Biosci.* 40 (2015):891–907
- Rohland, N.; Malaspina, A.; Pollack, J. L.; Slatkin, M.; Matheus, P. and Hofreiter, M. Proboscidean mitogenomics: chronology and mode of elephant evolution using mastodon as outgroup. *PLoS Biol.* 5(2007):1663–1671. (doi:10.1371/journal.pbio.0050207)

- Roos, C., Zinner, D., Kubatko, L.S. et al.. Nuclear versus mitochondrial DNA: evidence for hybridization in colobine monkeys. *BMC Evolutionary Biology* 11(2011):77.
- Srivastava, V.K. Religion and environment: a perspective from the community of Bishnois. Pp. 249-254 in: S.K. Chaudhury (ed.) *Culture, ecology and sustainable development*. Mittal Publications, New Delhi, 2006
- Sukumar, R.. *The living elephants: evolutionary ecology, behaviour and conservation*. Oxford University Press, New York, U.S.A., 2003
- Sukumar, R. 2011. *The story of Asia's elephants*. Marg Foundation, Mumbai.
- Sundar, K.P.G. The Indian sarus crane *Grus a. antigone*: a literature review. *Journal of Ecological Society* 16 (2003): 16-41.
- Thapar, V. *The cult of the tiger*. Oxford University Press, New Delhi, 2002.
- Thapar, V.; Thapar, R. and Ansari, Y. *Exotic aliens: the lion and the cheetah in India*. Aleph Book Company, New Delhi. 2013
- Thackston, W.M. *The Jahangirnama: memoirs of Jahangir, emperor of India* (translated, edited and annotated). Freer Gallery of Art and Arthur M. Sackler Gallery, Smithsonian Institution, Washington D.C. and Oxford University Press, New York, U.S.A. 1999
- Trautmann, T.R.. *Elephants and kings: an environmental history*. The University of Chicago Press, Chicago, U.S.A. 2015
- Vidya, T.N.C and Sukumar, R.. Social and reproductive behaviour in elephants. *Current Science* 89(2005):1200-1207.
- Vidya, T.N.C., Sukumar, R. and Melnick, D.J. . Range-wide mtDNA phylogeography yields insights into the origins of Asian elephants. *Proceedings of the Royal Society B* 276: (2009):893–902.
- Wang, N., Kimball, R.T., Braun, E.L., Liang, B. and Zhang, Z.. Assessing phylogenetic relationships among Galliformes: a multigene phylogeny with expanded taxon sampling in Phasianidae. *PLoS ONE* 8.5(2013):e64312. doi:10.1371/journal.pone.0064312.
- Wüster, W. Taxonomic changes and toxinology: systematic revisions of the Asiatic cobras (*Naja naja* species complex). *Toxicon* 34(1996):399-406.
- Wüster, W., Crookes, S., Ineich, I., Mane, Y., Pook, C.E., Trape, J-F., Broadley, D.G. The phylogeny of cobras inferred from mitochondrial DNA sequences: Evolution of venom spitting and the phylogeography of the African spitting cobras (Serpentes: Elapidae: *Naja nigricollis* complex). *Molecular Phylogenetics and Evolution* 45(2007):437–453.
- Zahavi, A.; Mate selection – selection for a handicap. *J. Theoretical Biol.* 53 (1975)205-214.
- Zahavi, A; and Zahavi, A. *The handicap principle: a missing piece of Darwin's puzzle*. Oxford University Press, New York, U.S.A., 1997