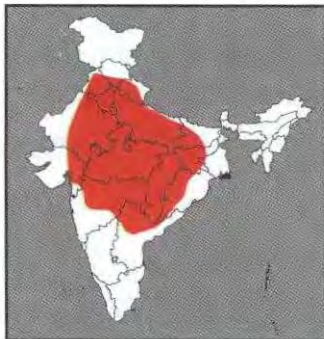


BLUE BULL OR NILGAI

(*Boselaphus tragocamelus* Pallas, 1766)

K. Sankar, A.J.T. Johnsingh and B. Acharya



Order	: Artiodactyla
Family	: Bovidae
Sub-Family	: Bovinae
Tribe	: Boselaphini
Genus	: <i>Boselaphus</i>
Species	: <i>B. tragocamelus</i>
Common name	: Nilgai, Blue bull

Conservation Status	
WPA (1972)	: Schedule III
IUCN RED DATA BOOK	: Lower risk
CITES	: Not listed

INTRODUCTION

Nilgai are the largest antelopes in Asia, about the size of a horse. Brander (1923) reported a 270 kg bull in central India. Walker (1968) reported that an adult nilgai weighs about 200 kg. Prater (1971) opined that bulls could weigh up to 270 kg. In Texas, 39 bulls averaged 241 kg and 23 adult cows 169 kg (Sheffield *et al.* 1983). An adult male stands 130 to 140 cm at the shoulder (Walker 1968, Prater 1971). Sale *et al.* (1988) reported shoulder height of eight bulls ranging from 130 to 150 cm (mean 138.4 cm) and for five cows from 100 to 130 cm (mean 116.8 cm), in Punjab, India. Bulls in Texas averaged 180 cm in length, 160 cm in chest girth, and 120 cm height at the shoulders. The corresponding dimensions for cows were 170 cm, 130 cm, and 120 cm respectively (Sheffield *et al.* 1983). Only male nilgai have horns which are short (15-20 cm), stout, conical and smooth in nature.





Nilgai calves and cows are light brown in colour. The light brown colour of male calves begins to darken by the tenth month and they develop black legs and brownish grey shoulders by 18 months. Adult nilgai bulls are steel-grey or blue grey in colour with black legs, which is developed by the fourth year (Sheffield *et al.* 1983). All individuals have dark and white markings on their heads, ears, under-parts, fetlocks, and tail, and prominent white vibrissa spots on the head. At the midpoint on the ventral side of the neck is a tuft of hair, more pronounced in bulls than in cows (Sheffield *et al.* 1983).

GEOGRAPHICAL AND ECOLOGICAL DISTRIBUTION

Nilgai are endemic to peninsular India. Historical records point out that all the Mughal emperors were extremely fond of hunting nilgai, especially Jehangir, credited with hunting down, among other animals, nearly 900 nilgai (Ali 1927). In the past, nilgai were distributed in open vegetation types all over India, down to Mettupalayam (latitude: 11° N) in south India (Brander 1923, Pythian-Adams 1951, Prater 1971). The present distribution of nilgai ranges from the Himalayan foothills, southward through central India, down to the southern districts of Andhra Pradesh. They are found in 114 Protected Areas of the country, in 16 States: Andhra Pradesh, Bihar, Chattisgarh, Gujarat, Haryana, Himachal Pradesh, Jammu and Kashmir, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Uttar Pradesh, Uttaranchal, Jharkhand and West Bengal. They are absent in the north-east India, and the southernmost parts of the peninsula. Nilgai have also been reported in Pakistan, mainly along the border with India (Mirza and Khan 1975, Roberts 1977) and in Nepal (Dinerstein 1979). Introduced nilgai populations occur in U.S.A., Mexico and South Africa (Lever 1985).

Nilgai occur near human habitations and crop fields outside protected areas. They are found in a variety of habitats, from level ground to undulating hills, in thin brush with scattered trees to cultivated plains, but not in dense forests and steep hills (Blanford 1888, Prater 1971). They are absent from the true arid zone where woody cover is inadequate to meet their requirements.

POPULATION

Though nilgai were once common throughout India (Adams 1858, Blanford 1888), like most large mammalian fauna of India, they have declined drastically because of habitat destruction and over-hunting (Schaller 1967).

Roberts (1977) reported that nilgai numbers are much reduced even in India, despite being regarded as sacred by the Hindu farming population. Their current population in India is yet to be assessed. Population figures are rarely available even from within the PAs from where they have been reported. Needless to say, estimating nilgai numbers outside PAs becomes even more difficult. However, a safe estimate of nilgai in India would be between 100,000 and 150,000. North-central India, covering four states (Haryana, Madhya Pradesh, Rajasthan, and Uttar Pradesh) account for a large majority (about 60%) of the total nilgai population in the country.

ECOLOGY

Group size and composition

Nilgai are partially social in their habits (Roberts 1977), although congregations and large groups are rare. According to Dinerstein (1980), nilgai occur in groups ranging from one to 10 individuals, and the mean group size observed in Karnali-Bardia in Nepal was 2.9. In Sariska, seasonal group size of nilgai (excluding single individuals) varied greatly, from two to 43 individuals, with a mean group size of 4.0 (Sankar 1994), with groups of up to five individuals formed 87 per cent of the groups observed. In Gir, Khan *et al.* (1995) reported mean group size of nilgai (including 'groups' of one) as 2.2, with high seasonal variability in group sizes.

According to Schaller (1967), nilgai groups change constantly, but three distinct kinds of groups are discernible: (i) one or two cows with young calves, (ii) 3 to 6 adult and yearling cows with calves, and (iii) male groups varying in number from 2 to 18. Sheffield *et al.* (1983) reported that in Texas, nilgai exhibited sexual segregation, except during the breeding season (December to March), when groups were formed with a male, and one or more cows and their calves. During the non-breeding season, especially the monsoon in India (July-October), bulls were usually found in all-male groups of less than 10 individuals, or sometimes in groups of 10 to 23, rarely more. Non-breeding cows and their calves occur mainly in groups of less than 16, often as singles and occasionally in larger groups of 16 to 24. During the breeding and calving seasons, this structure may change (Sankar 1994).

Sex ratio

Data from captive-bred nilgai indicated that the sex ratio of nilgai at birth is approximately even. Of the 535 nilgai born in zoos worldwide, 49%





were males and 51% females (Jarvis 1968, Lucas 1970). In India, the sex ratio (male:female) of free ranging adult nilgai favours females: 0.59:1 in Bharatpur (Schaller and Spillett 1966), 0.39:1 in Vanvihar Sanctuary (Schaller 1967), and 0.4:1 in Sariska (Sankar 1994). In Gir, down the years, the female-biased sex ratio of nilgai appears to be tilting more towards females: from 0.89:1 (Berwick and Jordan 1971) to 0.71:1 (Khan *et al.* 1995). In Texas, the observed male:female ratio was 0.81:1 (Sheffield *et al.* 1983).

The female:calf ratios for free-ranging nilgai are: 1:0.23 in Gir (Khan *et al.* 1995), 1:0.48 in Sariska (Sankar 1994), and 1:1.03 in Texas (Sheffield *et al.* 1983). The higher number of young in nilgai, as compared to sympatric ungulates, can be attributed to twinning (Kyle 1990, Sankar 1994) and strong defence of calves by cows making them less vulnerable to predation (Sankar 1994). One adult female nilgai in Sariska was observed guarding a 'creche' of four calves (A.J.T. Johnsingh pers. observ.). Of the 755 calves encountered in Sariska, 80 per cent were twins. The study on free-ranging nilgai in Texas also recorded births of triplets (Kyle 1990). The main reason for the lower female:fawn ratio in Texas was due to a combination of twinning and the total absence of any large predator there.

Reproduction

According to Prater (1934) and Asdell (1946), nilgai have no regular rutting season. In central India, Brander (1923) noticed calves of free-ranging nilgai in all seasons. In Bharatpur, most calves were born during the rainy season (June to October), and most breeding activity occurred from October to February, with a peak in November and December (Schaller 1967). Data from captive nilgai in zoos throughout the world showed that peak periods of birth last for 3 to 4 months, but these peak months varied from location to location (Sheffield *et al.* 1983). In Sariska, though new born nilgai calves were seen from July to November, most of the calving was observed in October and November (Sankar 1994). Judging from this fact, and the knowledge that their gestation period is 8 to 9 months (Crandall 1964, Prater 1971), nilgai in Sariska would have a peak rut from December to January.

Predation and mortality

Predation on nilgai by large predators like tiger (*Panthera tigris*) and leopard (*P. pardus*) in Rajaji (Johnsingh *et al.* 1993) and in Sariska (Sankar *et al.*

1993) was negligible. The same applied for the lions in Gir (Chellam 1993). Due to large body sizes and gregarious habits of adult nilgai, leopards (*Panthera pardus*) may find it very difficult to hunt them down. The preference of nilgai for human-dominated habitats make them less vulnerable to predation by tiger. Nilgai cows may be capable of defending their calves from predators. Sankar (1994) once observed an adult nilgai female with two young calves chasing away a tiger, and a dhole (*Cuon alpinus*) on another occasion. Very little information is available on mortality in nilgai other than natural predation. In Sariska, eight dead nilgai were diagnosed with symptoms of foot-and-mouth disease (FMD) (Sankar 1994). Nilgai, being an antelope and therefore less dependent on water, was least affected by the severe drought of 1988 in Sariska, when, of the 153 wild ungulates killed by the drought, only 18 were nilgai (Goyal *et al.* 1993).

Food habits

Studies on nilgai food habits showed that they are browsers (Berwick 1974, Mirza and Khan 1975, Dinerstein 1979, 1980) or mixed feeders (Haque 1990, Sankar 1994). In southern Texas, they are grazers (Sheffield *et al.* 1983). Nilgai can thrive upon variable proportions of grass, herbs, and browse, subject only to a minimum requirement of protein, which must not be below 8 per cent of their intake. A study of ungulate food habits in Nepal (Dinerstein 1979) indicated that sambar and nilgai feed on the same browse species. Apart from this, there is little information available on the dietary overlap between nilgai and other wild ungulates. According to Rodgers (1988), the large size of nilgai means they can exist on much poorer quality food items, making them coarser browsers. They are also fond of raiding crops and are regarded considered as pests in agriculture fields. Their ability to reach up to a height of 2.2 m height (bulls) helps in accessing forage in heavily grazed areas. At times, even female nilgai have been observed standing on hind legs and feeding on *Zizyphus mauritiana* leaves and fruits (K. Sankar *pers. observ.*). Nilgai was found associated with common langur (*Semnopithecus entellus*) in feeding areas in Sariska, gleaning food dropped by them.

In Sariska, nilgai fed on 91 plant species that included 20 tree, nine shrub, 12 creeper/straggler, 29 herb and 21 grass species (Sankar 1994). Grass formed an important component of nilgai diet during and soon after monsoon. During winter and summer nilgai fed on fallen leaves and fruits of *Zizyphus mauritiana*, fallen flowers of *Butea monosperma*, fallen pods of *Acacia nilotica*, *A. catechu* and *A. leucophloea*, and fallen leaves of *Anogeissus pendula*, along with grass and browse. Like most other mammals, freshly fallen flowers of mahua tree (*Madhuca indica*) are a favourite for chital in Central India. Analysis of preference





ratings and the dietary importance of browse species of nilgai in Sariska revealed that the leaves of *Capparis sepiaria* (crude protein content (CPC) = 10 to 14%), *Grewia flavescens* (CPC = 8 to 14%) and *Zizyphus mauritiana* (CPC = 3.9 to 10.5%) were the preferred plant species (Sankar 1994).

Habitat use and home range

Nilgai are found in open areas with undulating or flat terrain (Berwick 1974); they avoid dense hilly forests and prefer scrublands with low tree and shrub densities (Chakraborty 1991, Sankar 1994, Khan 1996). A radio-collared nilgai female had a mean seasonal home range of 3.6 km² in Sariska (Sankar 1994), and its annual home range was 7.3 km². In Texas, a nilgai female had a 0.6 km² home range, and the mean home range of eight bulls was 4.7 km² (Sheffield *et al.* 1983). In India, nilgai are generally considered diurnal (Brander 1923, Schaller 1967), and the same holds true for the Texan population, although some degree of nocturnal activity did occur (Sheffield *et al.* 1983). In Nepal, Dinerstein (1979) reported two activity peaks (0700 and 1800 hrs) for nilgai during summer, and a radio-collared nilgai female in Sariska also showed two activity peaks, 0700 to 0900 hrs, and 1600 to 1800 hrs during winter (Chakraborty 1991).

Water use

In Nepal, Dinerstein (1979) observed that the availability of surface water influenced the distribution and movements of ungulates including nilgai. According to Prater (1971) nilgai can go for long periods without water, and even during the hot weather, nilgai do not need to drink water regularly. Nilgai are reported to be water independent even in desert areas (Bohra *et al.* 1992). A 168 kg nilgai male in Texas drank up to 14 litres every 24 hours during July-August, when temperatures reached 40°C. During a drought in Texas in 1971, a radio-collared bull deserted a home range soon after all surface water had evaporated from there, and established a new range about 1.6 km away in an area with ponds (Sheffield *et al.* 1983).

BEHAVIOUR

Mating system

During the breeding season, the bulls move about in search of breeding cows, and upon finding one, defend the area around her from intrusions by other males – a system described as 'roving territoriality' (Sheffield

et al. 1983). Mature bulls maintain an area of dominance around themselves, whether or not cows are present. Breeding bulls respond to intrusions into these areas from other bulls by displays, threats, and chases, which either results in the intruding bulls leaving, or remaining in the area in a subordinate status. Courtship in nilgai is simple and involves a neck-stretched-forward, tail erect display by the male, showing the conspicuous white ventral side, and following the female in oestrus during a slow, sedate mating march.

Vocalisation

Although normally silent, nilgai have several vocalisations. Adults of both sexes, and calves as young as 5 months of age, sometimes utter a guttural alarm, more frequently when nilgai detects a hidden motionless observer, and especially when the wind direction is not in its favour. The call is audible for a distance of nearly 500 m. The alarm call of cows is of a higher pitch than that of bulls. Calves also call in a higher pitch, but much more softly. The alarm call of one group member usually alerts others, which sometimes join in. A low-pitched belching moan can be heard occasionally when one bull chases another (Sheffield *et al.* 1983). At times, cows produce a very low-pitched call to their calves (K. Sankar *pers. observ.*).

Display behaviour

Adult bulls display their dominance in many ways. A 'head-up' display consists of a raised muzzle exposing the white throat patch to adversaries. Another display is the 'horizontal-neck' display, where the head and neck is held stiff and stretched horizontal with the gular hair tuft and pinnae completing the picture. A bull would also exhibit a 'lateral display' when another male challenges him or when walking towards a subordinate. During the lateral display, the forelegs are held stiff, while the hind legs are brought forward under the body so that the rump is lowered and the back prominently arched. The head and neck are stretched forward, ears are held below horizontal and the male walks with short, slow, and deliberate steps. Viewed laterally, a displaying male appears massive at the chest and lower neck and relatively small at the rump. The eyes appear glazed and are rolled back, exposing the whites (Sheffield *et al.* 1983). During this process, the neck is stretched forward. Remarkably, this lateral display never occurs when opponents are very close to each other (Sheffield *et al.* 1983). Sometimes bulls also jerk their head down to point the tip of their horns to their opponents. Submissive behaviour recorded in Sariska included that of a sub-adult nilgai bull sitting on its belly with forelegs folded





beneath, and repeatedly butted the chin of an adult bull, which stood over it, extending its neck (A.J.T. Johnsingh *pers. observ.*).

Fighting

Walther (1974) described two types of fighting in nilgai bulls: (i) the combatants stand or kneel, and butt each other on the forehead with their horns, (ii) a neck-fight, in which both animals either stand or kneel, and push their necks against each other. Nilgai are the only bovids that exhibit neck-fighting between horned bulls. However, hornless cows of several bovids (including nilgai) neck-fight, which Walther (1974) considered phylogenetically very old, and suggested that it was also part of the behavioural repertoire of hornless ancestors of the modern horned ungulates. The persistence of this behaviour in nilgai bulls may relate to their relatively primitive horn structure. Since these horns are ineffective binding instruments, the common and more highly evolved head-to-head shoving with crossed horns (as observed in gazelle and kudu), has not developed in nilgai.

Calf behaviour

As seen in several species of ungulates, nilgai calves remain hidden for a while after birth, a habit called 'lying out'. Twin nilgai calves born in captivity spent their first 10 days sleeping inside a shed, and rising only to nurse at two-hour intervals (Lacey 1969). In Texas, the period of remaining hidden lying-out was about a month, after which the calves began travelling with their mother. This transition from lying-out to continued association with the mother appeared to occur gradually (Sheffield *et al.* 1983).

Dung piles

Nilgai have a characteristic habit of defecating repeatedly in the same location, resulting in the formation of large faecal piles or lavatory sites of nearly a meter in diameter (Brander 1923, Dharmakumarsinhji 1959, Schaller 1967). The social significance of this phenomenon is not yet clear. Schaller (1967) suggested that these piles might function as territorial markers, since the behaviour is characteristic of several species of African antelopes (Leuthold 1977). Contrastingly, in Texas, there was little evidence that nilgai were territorial despite using faecal piles (Sheffield *et al.* 1983). As evident from the different sizes of pellet groups at faecal piles, all age- and sex classes, including calves, use lavatory sites, although bulls undoubtedly use them more often than cows and calves (K. Sankar *pers. observ.*).



CONSERVATION

Although there has been a reduction in the overall range of nilgai, the existing populations seem to be doing fairly well. This is largely because of they are a protected species under the law, and more importantly the protection they acquire from being considered sacred due to their resemblance to domestic cows. Moreover, gradual degradation of dense forests into open scrub and thickets, increasingly bordered by agricultural fields, has offered favourable habitat conditions for the increase of nilgai numbers. Invariably, in such situations, nilgai become serious pests as crop raiders and a major issue of human-wildlife conflict. Possible solutions voiced include a selective culling programme linked to licensed hunting permits. However, throughout the range of the nilgai, most farmers are Hindus, and in Rajasthan and Haryana, many of them are Bishnois, a sect that rigorously protects all animals. Bishnoi farmers prefer to tolerate the raids on their crops rather than permit the slaughter of nilgai. So it is highly unlikely that any scheme to cull or ranch nilgai either for hunting or for local consumption will ever work in India (Kyle 1990). This attitude may however change, when the number of people living off the land increases, when the local people begin to believe nilgai are vermin or a source of meat. Relocations of problematic nilgai, for the time being, seem the safest solution.

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