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New Locality Record of an Isolated Population of *Axis porcinus* (Zimmermann, 1780) Across the Rural Landscape Near Roorkee, Uttarakhand, India

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ABSTRACT

A small, isolated population of *Axis porcinus* (Hog deer),surviving in a long stretch of agricultural fields have been recorded from a rural landscape in Narsan Block near Roorkee in Haridwar district of the north Indian State of Uttarakhand. The species is thriving across the inter-State boundary of Uttarakhand and Uttar Pradesh States. Considering the reliable records in the literature and preliminary observations, it appears that the species has a sparse distribution across the mosaic of agricultural fields near Roorkee (Uttarakhand) and Deoband (Uttar Pradesh), however, is uncommon. This is the first documented record, which confirms the presence of the species in Bangar plains in Uttarakhand State with photographic plates and notes on species' natural history. As the species is poorly studied in the State and data on its distribution and ecology is lacking, scientific studies, emphasizing on the species' re-assessment and population distribution are needed to be conducted to formulate a long-term conservation plan for this globally endangered species.

Keywords *Axis porcinus,* New locality record, Bangar plains, Uttarakhand, Natural history, North India.

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INTRODUCTION

Historically, the natural ranges of hog deer have been considered as northern parts of the Indian Subcontinent, especially along the valleys of the great rivers, and probably much of lowland and mainland of Southeast Asia (Schaller 1967, Prater 1971, Corbet and Hill 1992). Timmins *et al.* (2015) indicated that the species is distributed from Pakistan, through northern and north-eastern India, including the Himalayan foothill zone, east across non-Sundaic Southeast Asia and, marginally, southern China (southern Yunnan province), however, it is now reduced to isolated

subpopulations within its range.

Blanford (1888) indicated the presence of hog deer across the Indo-Gangetic plains, everywhere from Sind and Punjab to Assam with its frequent occurrence in Terai area. However, Grubb (2005) has indicated the distribution of hog deer in Bangladesh, Burma, Cambodia, China (Yunnan), North India, Laos, Nepal, Pakistan, Sri Lanka and South Vietnam. The species was introduced to Australia (Grubb 2005) and its presence in Sri Lanka still remains unclear (Biswas and Mathur 2000).The native range of species has been identified from Pakistan, Northern India, Nepal and Bhutan, through Bangladesh and Burma as far as Southern Thailand and Vietnam (Dhungel and O'Gara 1991, Biswas *et al.* 2002). A recent study has pointed out that the hog deer may have been extirpated from China, most likely as a result of habitat loss and overhunting (Ding *et al.* 2021).Brook *et al.* (2015) have indicated that its population has also been extirpated from Lao PDR, Vietnam and Thailand. The species is endemic to the tall moist grasslands of South and Southeast Asia and its populations are confined only to the flood plains of different river systems within its range countries (Biswas and Mathur 2000).

Two sub-species of the *Axis porcinus* have been reported from its geographical range. *Axis porcinus porcinus* (Indian subspecies, western race) is distributed from Pakistan (Roberts 1997) and the Terai grasslands in India (along the Himalayan foothills, from Punjab, in the west, to Arunachal Pradesh, in the east) through Nepal to Myanmar and in the floodplains of the rivers Ganges and Brahmaputra (Johnsingh *et al*. 2004, Menon 2014). However, *Axis porcinus annamiticus* (Southeast Asian subspecies, eastern race) is distributed across Thailand, Indo-China (in India found in Manipur), Laos, Cambodia and Vietnam (Biswas and Mathur 2000, Menon 2014, Gupta *et al.* 2018). The species is historically ranged widely across Southeast Asia, from Pakistan to southern China (Qureshi *et al.* 2025). At the beginning of the 20th century, it was widely distributed throughout the Southeast Asian countries; however, in recent decades, continued depletion of its habitat have resulted in a population decline, and it is confined to a few localities in its historical distribution range (Gupta *et al.* 2018).

In India, the distributional range of Indian subspecies is extended over the Indo-Gangetic plain (confined only to the foothills of Himalayas) across northern India through the States of Uttar Pradesh, Bihar and West Bengal to the Brahmaputra valley in Assam (Blanford 1888, Whitehead 1972, Biswas and Mathur 2000). Spillett (1966) indicated the range of Indian subspecies as the grasslands in Terai region of Uttar Pradesh and Assam i.e. the flood plains of Ganges and Bhramaputra. Further, Biswas *et al.* (2002) have reported its range in India from Punjab, Haryana, Uttar Pradesh, Bihar, West Bengal, Assam, Arunachal Pradesh, Tripura and Manipur, and Namdapha (in Arunachal Pradesh) and Corbett (in Uttarakhand) has been considered as the eastern and western most ranges of the species, respectively (Biswas *et al.* 2002). In the State of Uttarakhand, the species has so far been reported from the Terai region, including parts of Corbett Tiger Reserve. In Corbett National Park, the species have been observed occasionally in the valley of the Ramganga river but not in the surrounding hills (Schaller 1967).

Despite being an endangered species, it is one of the least studied species in Uttarakhand State and its distribution across the State has been overlooked. Besides, any authenticated information on the distribution of hog deer and its ecology in the State is not available so far. Though the species has sparse distribution across the State and adult and young individual resembles with spotted deer (*Axis axis*) and Indian muntjac (*Muntiacus muntjak*), especially in the field, there is often confusion about its presence. The hog deer has experienced drastic population declines throughout its geographical range and there is limited knowledge of its current population status (Sinha *et al.* 2019, Qureshi *et al.* 2025).The hog deer is listed as 'Endangered' species in the IUCN Red List of Threatened Species and is protected under Schedule I of the Indian Wild Life (Protection) Act, 1972. It is also listed in Appendix I of the CITES that are considered most endangered. Habitat fragmentation and alterations are main causes, which have led to the rapid decline in its populations. In this note, we report on a small isolated population of hog deer across Narsan block near Roorkee in Haridwar dis-

trict, Uttarakhand, which probably occur along the borders of the Uttarakhand and Uttar Pradesh States as proven by photograph. It also adds information on specific natural history traits.

MATERIALS AND METHODS

On 8 May 2025 (10.11 hr), an individual of adult female hog deer (locally known as Pada) was sighted in Gopalpur village, near Roorkee (29°43'17.9"N, 77°46'49.1"E). The spot from where the species was recorded is located across Narsan block, adjacent to the inter-State boundary of Uttarakhand and Uttar Pradesh States. In order to gather more information in the context of the species' abundance in the area, a rapid survey (for about a month) of the agricultural fields was conducted. Besides, perceptions of local people were also obtained about the occurrence of species in the area. Photographs of the species were also shown to the villagers for accurate identification of the species. The villagers confirmed the presence of the hog deer in the area, however, informed that the species usually seen individually or in small groups of two to three individuals in agricultural fields but is uncommon.

Later, on 9-10 May, 2025 (at 8.25 hr and 12.55 hr), two individuals of hog deer (one adult male and female), were sighted in the Tekaula Kalan (29°43'14.8"N, 77°48'19.4"E) and Nagla China (29°44'32.3"N, 77°53'27.7"E) villages, respectively, who strayed and entered erroneously into the human hamlets. Further, on 15 May, 2025 (17.20 hr), an individual of female hog deer was recorded from a sugarcane field, near Jathedi village (29°44'11.8"N, 77°49'29.0"E, Fig.1). Thereafter, last observation was made from Sakauti village (29°41'25.5"N, 77°51'54.2"E) on 22 May 2025, wherein a juvenile was seen feeding on *Saccharaum* spp. near upper Ganga canal.

The movement of the species has been observed from a series of villages namely, Tekaula Kalan, Narsan Kala, Gopalpur, Ulheda, Mohammadpur Jat, Sherpur, Jathedi, Lakhnauta and Sakauti, bordering the Uttar Pradesh State. As per the discussions held with forest officials and local people, the species has been wandering in the area since last 4-5 years and during 2024, an individual was observed from Gadar Judda village (close to Nagla China village), which is not connected with the series of villages from where the species has been observed. Considering the observations, it was apparent that the species has some degree of association with agricultural fields, which serves as an important habitat for the species in the area. The area do not consist of any patch of natural forest, however, quite a few small patches of grasses, mainly *Saccharaum spp*. exist along the

Fig. 1. An individual of hog deer at Jathedi village near Roorkee, Uttarakhand.

Upper Ganga canal.

RESULTS AND DISCUSSION

From the field surveys, it has been observed that a small population of hog deer has a patchy distribution in the area, which reside within the agricultural fields throughout the year. Further, this population moves across the agricultural fields bordering Uttarakhand and Uttar Pradesh States. Similar observations have also been made from the Hastinapur Wildlife Sanctuary, wherein Biswas *et al.* (2002) have pointed out that the hog deer seemed to reside within the agricultural fields throughout the year, largely due to lack of any undisturbed patches of grassland. The area lies across the Bangar area and falls within the upper Gangetic plains biogeographic zone. Since the establishment of the State of Uttarakhand in 2000, a major shift has been observed in the land use pattern with expansion in human settlements area. Biswas and Mathur (2000) has carried out a review of the conservation scenario of hog deer in its native range and indicated that large-scale transformations occurred in the native range of hog deer mainly due to agricultural developments in the Indo-Gangetic belt.

Discussions held with local people and forest officials revealed that though the movement of species has been occurring in the agricultural fields (Sugarcane, wheat and paddy are the main crops) throughout the year, it increases during March to August, when wheat, paddy, maize and sugarcane are cultivated/ harvested. The hog deer usually remain hidden in the agricultural fields during day hours and their movement in open areas has been more markedly observed during early morning and evening hours. They tend to take shelter in areas having bushes and plantations after the harvesting, during which period, incidences of their wandering across the villages increases significantly.

Though, the species has been documented from Rajaji and Corbett National Parks earlier (Sinha 1995, Sati and Tak 2008) and some of the workers have included the species in the checklist of the State's fauna (Singh *et al.* 2021,Kumar *et al.* 2022), data on its distribution/abundance in specific locations (other than Corbett Tiger Reserve) is not available. Recently, an individual of hog deer has been documented from the Rajaji Tiger Reserve (Tyagi 2024), prior to this observation, Pandav (2004) observed two individuals of hog deer near Bhimgoda barrage across Ganga river and Rajaji National Park. According to the last population estimate conducted in 2021 in the State, a total of 26 hog deer were recorded from the Corbett National Park and around 15 from the Terai West area (Azad 2025). The Working Plan of the Haridwar Forest Division, in which Roorkee forest range lies, mentions about the presence of species in division (Pal and Sinha 2012), however, locality has not been stated. Further, in order to monitor the dwindling population of the species in Uttarakhand, the State Government has initiated surveys in Rajaji and Corbett landscapes (Azad 2025).Biswas *et al*. (2002) have pointed out that Corbett although has abundant population of hog deer and has small and fragmented patches of grasslands at Paterpani and Dhikala, which might not be conducive to the long-term survival of species.

Considering the surveys and discussions with local people, it appears that the species is also present across riparian corridors of Banganga river, which is a tributary to the Ganges (most probably in swampy/ marshy grasslands) near Laksar (towards east; ~20 kilometers far from the study area) and Chiriapur area of Haridwar district. However, their distribution status and actual number is still unknown. Pandav (2004) has indicated that the hog deer still exist in extremely low densities in the marshy areas along the Banganga river. Banganga area is contiguous with the Hastinapur Wildlife Sanctuary in Uttar Pradesh State, where hog deer exist (Khan 2014, Mondol *et al.* 2019). Tewari and Rawat (2013) has indicated the presence of hog deer in Jhilmil Jheel Conservation Reserve, which is located near to the Ganges in Haridwar. Similarly, Pandav (2004) indicated that hog deer once occurred in the Doon valley in low density was unfortunately disappeared due habitat destruction. The Hastinapur Wildlife Sanctuary is located approximately 65 kilometers from the spot (towards South), however, Haiderpur Wetland is located about 45 kilometers from the spot (towards Southeast). Similarly, Rajaji National Park and Jhilmil Jheel Conservation Reserve are situated about 35 and 45 kilometers, respectively, from the spot (towards

Northeast and East).

In India, there is not much information available on the current status and distribution of hog deer (Biswas and Mathur 2000). Though, the species has been abundant in Corbett National Park, Dudhwa National Park, Katerniaghat Wildlife Sanctuary and adjoining areas in the State of Uttar Pradesh, reports of straying of species were also received from different parts of the State during last 4-5 years, viz. Mirzapur, Mathura and Ghaziabad (Anonymous 2020, Anonymous 2022, Jha 2024). Similarly, the presence of hog deer has also been recorded from the Yamuna Biodiversity Park, located across the outskirts of Delhi (Singh *et al.* 2023). Biswas *et al.* (2002) have indicated the presence of the species across Corbett National Park (in Uttarakhand State) and across Dudhwa National Park, Hastinapur, Katerniaghat, Kishanpur Wildlife Sanctuaries, north Kheri Forest Division, Garmukteshwar, Khadar area and Mirzapur area in Muzzafarnagar district in Uttar Pradesh State, respectively.

Hog deer bear little resemblance with the spotted deer. The upper coat is usually brown with yellowish or reddish tinge and the underside of the body is whitish in appearance. The young are spotted indistinctly on the flanks while adults have speckled appearance due to the white-tipped hairs on the coat (Menon 2014). During winter, the hog deer's coat becomes darker while in summer, it exhibits a yellowish hue with faint white or pale brown spots (Qureshi *et al.* 2025). The tail is medium length and the under parts of tail is white. Males are slight larger and darker than that females and has stags, while the female lack antlers. The hog deer has relatively short legs (Prater 1971) with its body being lower in the front than the back. Being a deer, only males have antlers, which shed annually. Madhushanka *et al.* (2025) have categorized the antler stage of hog deer into three distinct phases based on age and antler morphology viz. single spike (in one-year-old stags), short-forked antler (in two-year-old stags) and long three-spiked antler (in fully grown adult stags).

The hog deer typically inhabit moist grasslands near rivers (Blanford 1888, Prater 1971, Biswas and Mathur 2000, Menon 2014). Riparian corridors, river banks, marshy lands and open grasslands provide suitable habitat and grazing grounds to the species. Hog deer has small home ranges, the mean of which have been estimated as 60-80 hectares (Dhungel and O'Gara 1991). The diet comprises of grasses, shoots, flowers, fruits and barks of various plant species (Bhowmik and Chakraborty 1999).A study carried out in the outer Himalayan foothills in West Bengal recorded *Saccharum* spp., *Alpinia* spp., *Phragmites karka, Arundo donax* and *Imperata cylindrical* as food items of species, and among all *Saccharum* spp. is one of the preferred food item (Bhowmik *et al.* 1999). The mating season of the hog deer has been considered as September-October. As the gestation period is estimated as about seven months, young ones are usually seen during April-May (Prater 1971, Dhungel and O'Gara 1991). Female usually give birth to a single baby (Dhungel and O'Gara 1991).

The hog deer is a shy and solitary species (Prater 1971), rarely seen in groups (Maze and Moore 1990). Females are seen with their young, and males are seen with females during the rutting period. They spend most of their time hidden in thick vegetation, only emerging during the hours of darkness to feed on various grasses, herbaceous plants and riverside vegetation. They feed during early morning and evening hours and shelter in long grasses/bushes during daytime, especially during summer.

Some of the threats observed in the area are killing of hog deer by the feral dogs, livestock grazing and unawareness about the ecological role of species in maintaining the biodiversity. In Manas National Park, one of the emerging threat to the species was recorded as attack by feral dogs, although the dogs were not observed feeding on them (Sinha *et al.* 2019). Considering that records for the presence of hog deer in the area were previously unconfirmed, our report provides the new locality record of the species in Bangar plains in Uttarakhand State. However, due to the lack of information on the status of the species in the area, it cannot be proven whether the species is locally threatened with extinction. Hog deer is commonly found across Terai area in Uttarakhand State, especially in Corbett Tiger Reserve. Presence of hog deer across inter-State border of Uttarakhand and Uttar Pradesh indicates survival of its meta-pop-

ulation, which is sporadic and may move across the Baanganga wetland and Jhilmil Jheel Conservation Reserve in Haridwar. As hog deer prefer to inhabit tall grasslands, the agricultural fields in area might be a good refuge to the species' survival (VB Mathur, Per. Communication).

CONCLUSION

As the area has been serving as an important habitat for hog deer in Uttarakhand, immediate conservation attention is needed to be given to protect this isolated unidentified population. Captive breeding program may be helpful in increasing its population, which has brought back the population of hog deer to sustainable level in Thailand (Seritrakul *et al.* 2022). Since hog deer is a grassland-based species, there is a need to protect the large patches of natural grasslands around its natural habitat, especially marshy grasslands. Since Indo-Gangetic plains constitutes an important faunal repository, it is proposed that a baseline study be initiated to demark the geographical distribution and status of hog deer in the State. Additional studies, especially across the Baanganga, Jhilmil Jheel Conservation Reserve and rural areas, area adjacent to these wetlands having a mosaic of grasslands, are needed to better understand the natural history and ecology of this poorly studied species. Further, radio-telemetric studies would contribute in understanding its distribution, local movement patterns, home ranges and habitat use. Moreover, demarcation of potential habitats and protection of the species by establishing 'Community Reserve' and ensuring the community's participation would be an effective conservation strategy.

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REFERENCES

Anonymous. (2020). Exclusive-Rare 'Hog Deer' found in Mirzapur for the first time. Vindhyan Ecology & Natural History Foundation. https://vindhyabachao.org/embeds/Hog_Deer_discovery_Mirzapur_May_2020.pdf

Anonymous. (2022). Hog deer rescued after being attacked by dogs in Mathura. Hindustan Times, 18 April 2022. https://www.hindustantimes.com/cities/others/hog-deer-rescued-after-being-attacked-by-dogs-in-mathura-101650224359495.html#google_vignette

Azad, S. (2025). U'khand launches survey to track hog deer in Rajaji, Corbett. The Times of India, 7 May 2025. https://time-sofindia.indiatimes.com/city/dehradun/ukhand-launch essurvey-to-track-hog-deer-in-rajaji-corbett/article show/120972135.cms

Bhowmik, M. K., & Chakraborty, T. (1999). Feeds and feeding habits of hog deer (*Axis porcinus*) in protected areas of sub-Himalayan West Bengal. *Indian Journal of Animal Health,* 38(1), 39-40.

Bhowmik, M. K., Chakraborty, T., & Raha, A. K. (1999). The habitat and food habits of hog deer (*Axis porcinus*) in protected areas of sub-Himalayan West Bengal. *Tigerpaper,* 26(2), 25-27.

Biswas, T., & Mathur, V. B. (2000). A review of the present conservation scenario of hog deer (*Axis porcinus*) in its native range. *Indian Forester,* 126(10), 1068-1084.

Biswas, T., Mathur, V. B., & Sawarkar, V. B. (2002). Status and distribution of hog deer (*Axis porcinus*) in India. Report, Wildlife Institute of India, Dehradun.

Blanford, W. T. (1888). The fauna of British India including Ceylon and Burma. Taylor and Francis, Berlin.

Brook, S. M., Nasak, C., & Channa, P. (2015). Indochinese hog deer Axis porcinus annamiticus on the brink of extinction. Deer Specialist Group Newsletter, 27, 14-31.

Corbet, G. B., & Hill, J. E. (1992). The mammals of the Indoma layan region: a systematic review. Oxford University Press, Oxford.

Dhungel, S. K., & O'Gara, B. W. (1991). Ecology of the hog deer in Royal Chitwan National Park, Nepal. *Wildlife Monographs,* 119, 3-40. http://www.jstor.org/stable/3830632

Ding, C., Liu, J., Li, C., & Jiang, Z. (2021). Probable extirpation of the hog deer from China: implications for conservation. *Oryx,* 56(3), 360-366. https://doi:10.1017/S0030605321000016

Grubb, P. (2005). Order Artiodactyla. In: Wilson DE, Reeder DM (eds) Mammal species of the World, a taxonomic and geographic reference, 3rd edn. The Johns Hopkins University Press, Baltimore, Maryland, pp 637-722.

Gupta, S. K., Kumar, A., Angom, S., Singh, B., Ghazi, M. G. U, Tuboi, C., & Hussain, S. A. (2018). Genetic analysis of endangered hog deer (*Axis porcinus*) reveals two distinct lineages from the Indian subcontinent. *Scientific Reports,* 8, 16308. https://doi: 10.1038/s41598-018-34482-9

Jha, A. (2024). Hog deer chased by dogs rescued in Dasna. The Times of India, 11 Feb 2024. https://timesofindia.indiatimes.com/city/ghaziabad/hog-deer-rescued-in-dasna-ghazia bad-endangered-species/articleshow/107593415.cms

Johnsingh, A. J. T., Ramesh, K., Qureshi, Q., David, A., Goyal, S. P., Rawat, G. S., Rajapandian, K., & Prasad, S. (2004). Conservation status of tiger and associated species in the Terai Arc Landscape, India. Report, Wildlife Institute of India, Dehradun, India.

Khan, A. (2014). Hastinapur Conservation Plan. Technical Report. https://www.researchgate.net/publication/379512008_Hastinapur_Conservation_Plan

Kumar, A., Sharma, G., & Khan, I. A. (2022). Checklist of

mammals of Uttarakhand, India. *Records of the Zoological Survey of India,* 122(1), 1-16. https://doi.org/10.26515/rzsi/v122/i1/2022/165748

Madhushanka, S., Weerasekara, D. S., Medawala, M., & Ranawana, K. B. (2025). Seasonal patterns of hog deer (*Axis porcinus*) antler development in Sri Lanka. *World News of Natural Sciences,* 58, 142-149.

Maze, R. J., & Moore, G. I. (1990). The Hog Deer. The Australian Deer Foundation Ltd. Croydon, Vic.

Menon, V. (2014). Indian mammals, a field guide. Hachette India.

Mondol, S., Pandav, B., Kumar, M., Paul, S., & Saha, S. (2019). Assessment of wildlife habitats with special focus on swamp deer in Hastinapur Wildlife Sanctuary, Uttar Pradesh, India. Report, Uttar Pradesh Forest Department.

Pal, M. S., & Sinha, A. R. (2012). Management Plan (2012-13 to 2021-22) of Haridwar Forest Division.

Pandav, B. (2004). Occurrence of hog deer (*Axis porcinus*) near Bhimgoda barrage across Ganga river. Wildlife Institute of India Newsletter 11(1),7-8.

Prater, S. H. (1971). The book of Indian animals. Bombay Natural History Society. Mumbai: Oxford University Press.

Qureshi, Q., Kolipakam, V., Jhala, Y. V., Kumar, U., Habib, B., Mathur, V. C., Mallick, A., Yadav, S. P., Bharadwaj, G. S., & Tiwari, V. R. (2025). Status of ungulates in tiger habitats of India. Report, National Tiger Conservation Authority, New Delhi and Wildlife Institute of India, Dehradun.

Roberts, T. J. (1997). The Mammals of Pakistan. Oxford University Press, Karachi.

Sati, J. P., & Tak, P. C. (2008). Mammalia. In: Director, Zoological Survey of India (ed) Fauna of Corbett Tiger Reserve, Fauna of Conservation Areas Series 5. Zoological Survey of India, Kolkata, pp. 63-82. https://archive.org/details/dli.zoological.cas.035/page/n69/mode/2up

Schaller, G. B. (1967). The deer and tiger. The University of Chicago Press, Chicago.

Seritrakul, P., Kliangthip, W., Khamkha, S., & Laosutthipong, C. (2022). Mitochondrial DNA analysis revealed genetic diversity of captive-bred hog deer (*Axis porcinus*) population in Thailand. *International Journal of Agricultural Technology,* 18(3), 1247-1260.

Singh, R., Raturi, R., Dhodi, R., Dhodi, R., Uniyal, S., Sharma, S., Merugu, R., Prasad, C., Akash, Deep., & Kumar, R. (2021). Wildlife diversity along the altitudinal gradients in the Garhwal Himalaya. *Asian Journal of Conservation Biology*, 10(1), 99-114. https://doi.org/10.53562/ajcb./YGVB6243.

Singh, M., Gautam, S., Srivastava, D. P., Jain, P., Sirohi, U., Singh, H., Arjun, Khurana E., & Khudsar, F. A. (2023). Hog deer Axis porcinus reclaiming historical geographical distribution range due to ecological restoration in the Yamuna Biodiversity Park, Delhi, India. *Species,* 24, e84s1596.

Sinha, N. K. (1995). Mammals (Mammalia). In: Director, Zoological Survey of India (ed) Fauna of Rajaji National Park, Fauna of Conservation Areas 5. Zoological Survey of India, Kolkata, pp 9-23.

Sinha, A., Lahkar, B. P., & Hussain, S. A. (2019). Current population status of the endangered hog deer *Axis porcinus* (Mammalia: Cetartiodactyla: Cervidae) in the Terai grasslands: a study following political unrest in Manas National Park, India. *Journal of Threatened Taxa,* 11(13),14655–14662. https://doi.org/10.11609/jott.5037.11.13.14655-14662

Spillett, J. J. (1966). A report of wildlife surveys in north India and southern Nepal. *Journal of Bombay Natural History Society,* 63(3), 492-628.

Tewari, R., & Rawat, G. S. (2013). Studies on the food and feeding habits of swamp deer (*Rucervus duvaucelii duvaucelii*) in Jhilmil Jheel Conservation Reserve, Haridwar, Uttarakhand, India. *International Scholarly Research Notices,* Article ID 278213. http://dx.doi.org/10.1155/2013/278213

Timmins, R., Duckworth, J. W., Samba, K. N., Anwarul, Islam M., Sagar Baral, H., Long, B., & Maxwell, A. (2015). *Axis porcinus.* The IUCN Red List of Threatened Species 2015:e. T41784A22157664.http://dx.doi.org/10.2305/IUCN.UK.2015-4.RLTS.T41784A22157664.en

Tyagi, T. (2024). In a first, hog deer spotted inside Rajaji Tiger Reserve. The Times of India, 6 January 2024. https://timesofindia.indiatimes.com/city/dehradun/in-a-first-hog-deer-spotted-inside-rajaji-tiger-reserve/articleshow/106588427.cms

Whitehead, G.K. (1972). Deer of the World. Viking Press, New York.