The maximum size of the greater one-horned rhinoceros (*Rhinoceros unicornis*)

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Introduction

Data on the size of *Rhinoceros unicornis* individuals in the wild are only reported in rare cases, usually after the animal was killed or more recently during translocation exercises. In a survey of literature, records regarding body length, height at shoulder, girth and horn length have been collated and calculated in metric dimensions. The maximum figures are body length to 436 cm, height at shoulder to 206 cm, girth of body to 380 cm and horn length to 61 cm.

Watching a rhinoceros in its natural habitat while cruising in a tourist jeep, it is impossible to estimate the size of the animals with any amount of accuracy. It is easier in a zoological garden if the animals are trained to allow human interaction, but records of size are rarely if ever published, and it is always possible that their captive diet has some impact on the results.

In the general literature about the rhinoceros there are of course indications of the animal's size, either as average or as a range from minimum to maximum. Such figures are meant to give an idea of the bulk of adult animals, in few cases males and females are distinguished. Generally, there is a lack of discussion on how the figures were calculated.

In a survey of literature while working on a history of the rhinoceros in South Asia, I have tried to consistently record the sizes provided by authors who took measurements of rhinos in the field, usually after the animal had been killed. This is unlikely to be an unbiased sample, which would allow calculating some kind of average, because hunters were likely to shoot the biggest and best, or just provide measurements when an exceptional animal had been obtained.

There are definitely pitfalls when using such data by hunters and adventurers. Their methods may have differed considerably, they may not have been particularly knowledgeable about taking measurements, they used a variety of units–and in practice their statements are unverifiable. I have re-calculated all figures into metric centimetres (cm), from feet (ft = 30.48 cm) and inches (in = 2.54 cm) as well as hands (10.2 cm).

A comparison of the general statements in the recent literature and the records of the largest animals killed appeared to show that the upper margins in the size ranges were often too low. Therefore, it is useful to provide all available data. It is not useful to discuss the minimum size of an adult, or average size, because the reports in the literature are really too few to shed any light on that. Similarly, the sexes of the animals are, unexpectedly maybe, rarely recorded, and shed no light on any sexual differences there might be.

In the 19th century, the London taxidermist Rowland Ward set the standards for measuring and recording trophies. Using the tiger as an example, he recommended that animals were measured in the field between pegs, where pegs are placed are placed by the nose, the nape of the neck, the root of the tail and the tip of the tail (Ward 1899). Maximum lengths would therefore include the tail stretched out, adding about 50–60 cm to the total.

The measurements of the pseudonymous B H B A M B T (1822) of a specimen in Dinagepore (Dinajpur, NW Bangladesh) are discarded, because the size of the animal appears imaginary, with a length of 482 cm (15 ft 10 in), height of 226 cm (7 ft 5 in) and horn length of 53.3 cm (21 in).

Two sets of measurements can be highlighted. Dinerstein (1991, 2003) provided statistics of animals examined during translocation exercises in Nepal in 1985-1988, thereby creating a unique set of data based on a larger number of animals. He separated the data set into calves, sub adults, young adults and older adult males and females. For maximum sizes I have of course only taken the older adults into account.



Figure 1. Large rhinoceros shot in Cooch Behar in 1889 (Nripendra 1908).

Dinerstein found that males (411.7 cm) were on average slightly larger than females (399.2 cm).

The second set is found in the hunting records of the Maharajah of Cooch Behar spanning from 1871 to 1909 (fig. 1). In an appendix, Nripendra (1908:454) gave records of 13 of the largest animals shot in this region of West Bengal. In this table, (the length measured "between sticks"), the largest specimens are said to be a female of 1890 being 370.8 cm long and 175.6 cm high, and a male of 1895 being 388.6 cm long and 194.6 cm high. However, there are measurements of three large rhinos shot in Cooch Behar listed by Ward (1910), which may agree in height but certainly were said to be longer. Rowland Ward probably, lists the large male of 1895 with a similar height of 193.7 cm (against 194.6 cm), but with a greatly larger length of 429.2 cm (against 388.6 cm), which must be explained by differences in the method of measuring.

In this paper I will collate the records of the maximum size of wild *Rhinoceros unicornis* individuals for which exact records have been published over the years for body length, height at shoulder, girth and horn length.

1. Body length

The general size ranges published nowadays often have a maximum of 380 cm or less for total length including tail, e.g. Laurie (1978:422), Zecchini (1998), Mazumdar and Mahanto (2016). Penny (1987) recorded a range of 210-420 cm. The measurements taken in Nepal by Dinerstein (1991, 2003:272) gave averages of 399 cm ± 24.7 (n=9) for females, and 411.7 cm ± 20.6 (n=15) for males. This agrees with the 412 cm reported by Laurie et al. (1983).

None of the individual records in the literature refer to animals in Nepal. Animals with a length above 4 m are definitely rare. However, 10 such animals have been measured (Table 1). Rowland Ward (1910), in his work on large trophies, listed three specimens killed in Cooch Behar with record lengths, up to 429 cm. I don't quite understand the difference between the measurements published by the Maharajah of Cooch Behar taken in the field and those reported by Rowland Ward from the trophies, but possibly do relate to the same specimens.

The largest length recorded is 436 cm. In view of this, it is suggested that the maximum length of the species should be stated as reaching 436 cm.

Table 1. The greatest body lengths recorded for wild specimens of *Rhinoceros unicornis*.

LOCALITY	TOTAL LENGTH OF BODY	OBSERVATIONS
Cooch Behar 1891, male	370.8 cm = 12 ft 2 in	Nripendra 1908:454
Cooch Behar 1890, largest female	370.8 cm = 12 ft 2 in	Nripendra 1908:454
Cooch Behar 1897	373.3 cm = 12 ft 3 in	Nripendra 1908:210
Cooch Behar 1892, male	373.3 cm = 12 ft 3 in	Nripendra 1908:454
Cooch Behar 1886, male	380.9 cm = 12 ft 6 in	Nripendra 1908:454
Assam	381.0 cm = 12 ft ½ in	Pollok 1897:256
Cooch Behar 1902, male	388.6 cm = 12 ft 9 in	Nripendra 1908:454
Cooch Behar 1895, largest male	388.6 cm = 12 ft 9 in	Nripendra 1908:454
Cooch Behar 1895 (also largest male?)	391.2 cm = 12 ft 10 in	Nripendra 1908:166,165
Cooch Behar 1885	401.3 cm = 13 ft 2 in	Nripendra 1908:33
Cooch Behar (1)	401.3 cm = 13 ft 2 in	Ward 1910:464
Manas	406.4 cm = 13 ft 4 in	Pollok 1882:58; Pollok & Thom 1900:466
Cooch Behar (2)	421.6 cm = 13 ft 10 in	Ward 1910:464
Cooch Behar 1886, male	422.0 cm = 13 ft 10 in	Nripendra 1908:45
Purneah	426.7 cm = 14 ft 0 in	Bruiser 1871
Cooch Behar (also largest male ?)	429.2 cm = 14 ft 1 in	Ward 1910:464
Assam	433.0 cm = 14 ft 2 ½ in	Sarel 1887:360
India	436.9 cm = 14 ft 4 in	Young Nimrod 1875

2. Height at shoulder

The study in Nepal by Dinerstein (1991, 2003) gave a size range for shoulder height of 172.3 cm ± 14.2 in males (n=4) and 149.3 cm ± 14.7 in females (n=3). Laurie et al. (1983) gave a range of 163–193 cm (n=9), with average 175.4 cm in males. This is only exceeded at the top end by the range of 172–198 cm by Ward (1938).

There have only been two records for the shoulder height above 2 metres (Table 2). One animal from Bihar was measured at just under 206 cm. Surely such heights are exceptional, but a range upto that figure is suggested.

3. Girth

The girth, or circumference of the body, is a rather odd measurement, as it would take some time to find the place on the body where this is the largest. Dinerstein (1991, 2003), in his study in Nepal, gave figures of 314.5 cm ± 28.1 in males (n=4) and 298.7 cm ± 41.5 in females (n=3). Laurie et al. (1983) gave a figure of 396 cm, which is the highest found in the general recent literature.

The figures provided for wild specimens measured in the field are from 302–381 cm (Table 3). However, the larger measurement of 396 cm is not inherently impossible and that can be taken as the maximum girth of the species.

4. Horn length

The maximum horn length for any rhinoceros species is a figure often repeated in the literature. The *Records of Big Game* maintained by Rowland Ward since 1892 are of course authoritative, although the list is not meant to disclose the whereabouts of each specimen. The records of the largest horns are found in Table 4. It will be noted that the largest horn obtained in Cooch Behar measured only 41.3 cm, just two-thirds of the larger ones found elsewhere, despite the large size of some of the animals. Horn length is not an indicator of body size.

A very large horn from Assam, said to be 61.5 cm, was recorded by Barua and Das (1969:26) in the Assam State Museum, Guwahati (fig. 2). When I visited the museum, within the zoo premises, in 2019, the horn was not found. It is likely that it was transferred to the Assam State Treasury, although a recent survey

Table 2. The greatest shoulder heights recorded for wild specimens *Rhinoceros unicornis*.

LOCALITY	TOTAL LENGTH OF BODY	OBSERVATIONS
Cooch Behar 1890, largest female	175.6 cm = 17 hand 1 in	Nripendra 1908:454
Bihar	176.5 cm = 5 ft 9 ½ in	Inglis 1892:299
Cooch Behar 1892, male	182.0 cm = 17 hands 3 ½ in	Nripendra 1908:454
Cooch Behar	184.1 cm = 6 ft ½ in	Ward 1910:464
Cooch Behar	185.4 cm = 6 ft 1 in	Ward 1910:464
Manas	188.0 cm = 6 ft 2 in	Pollok 1879, I: 95, II: 126; Pollok 1882:58; Pollok 1897:256; Pollok & Thom 1900:466
Cooch Behar 1886, male	189 cm = 18 hands 0 in	Nripendra 1908:454
Cooch Behar 1898, male	189.8 cm = 18 hands 1/3 in	Nripendra 1908:454
Cooch Behar 1893, male	190.3 cm = 18 hands ½ in	Nripendra 1908:454; Jenkins 1893:207
Cooch Behar 1886, male	190.3 cm = 18 hands ½ in	Nripendra 1908:45, 454
Assam, Goalpara	190.5 cm = 6 ft 3 in	Cock 1865
India	190.5 cm = 6 ft 3 in	Young Nimrod 1875
Cooch Behar 1889, male	191.5 cm = 18 hands 1 in	Nripendra 1908:454
Cooch Behar 1895, male	191.5 cm = 18 hands 1 in	Nripendra 1908:145, 454
Assam	193.0 cm = 6 ft 4 in	Anon 1909
Cooch Behar (largest male ?)	193.7 cm = 6 ft 4 ¼ in	Ward 1910:464
Cooch Behar 1902, largest male	194.5 cm = 19 hands ¼ in	Nripendra 1908:454
Purneah	195.5 cm = 6 ft 5 in	Bruiser 1871
Cooch Behar 1895 (also largest male?)	201.4 cm = 19 hands 3 in	Nripendra 1908:166,165
Bihar, Purneah: Koosee River	205.8 cm = 6 ft 9 in	Inglis 1878:212, 1892:556; Maori 1874

Table 3. The greatest girths recorded for wild specimens of *Rhinoceros unicornis*.

LOCALITY	TOTAL LENGTH OF BODY	OBSERVATIONS
Cooch Behar 1902, largest male	302.3 cm = 119 in	Nripendra 1908:454
Bihar, Purneah: Koosee River	305.0 cm = just over 10 ft	Inglis 1878:212, 1892:556; Maori 1874
Cooch Behar 1890, largest female	315.0 cm = 124 in	Nripendra 1908:454
Cooch Behar 1892, male	315.0 cm = 124 in	Nripendra 1908:454
Nepal, Kathmandu Menagerie	316.3 cm = 10 ft 5 in	Hodgson 1834:98
Bihar, Purneah	327.7 cm = 10 ft 9 in	Bruiser 1871
Bihar	349.2 cm = 11 ft 5 ½ in	Inglis 1892:299
Nepal	365.7 cm = 12 ft	Ellison 1925:33
Nepal	380.9 cm = 12 ft 6 in	Ellison 1925:33

Table 4. The greatest horn lengths recorded for wild specimens of *Rhinoceros unicornis*.

LOCALITY	TOTAL LENGTH OF BODY	OBSERVATIONS
Cooch Behar (1898; largest in area)	41.3 cm = 16 ¼ in	Ward 1910:464
Assam (1902, M.H. Logan)	45.7 cm = 18 in	Ward et al. 1935:335
Assam (1913, D.H. Felce)	46.7 cm = 18 3/8 in	Ward et al. 1935:335
Assam, Singpho (1921, C.A. Elliot)	48.3 cm = 19 in	Ward et al. 1935:337
Assam (1909, Ipswich Museum)	49.2 cm = 19 1/8 in	Ward 1910:464
Nepal (1933, Maharaja of Surguja)	49.5 cm = 19 ½ in	Ward et al. 1935:337
Nepal (1901, Curzon at Morang)	54.0 cm = 21 ½ in	Ellison 1925:33; Ward 1910:464
Assam (trophy horn)	57.2 cm	Laurie et al. 1983
India (Jerdon)	61.0 cm = 24 in	Ward 1899:433
Assam (1909, Briscoe, in NHM)	61.0 cm = 24 in	Ward 1910:464
Assam (Assam Forest Museum)	61.5 cm	Barua & Das 1969:26
Assam (Briscoe, in NHM)	61.6 cm = 24 ¼ in	Anon 1909

reported in the media in 2016 seems to indicate that the longest in that repository is 46 cm. A search for this extremely long horn is advisable.

Two record horns stand out. For a long time, the horn of 54.0 cm obtained by the Viceroy of India, George Curzon, 1st Marquess Curzon of Kedleston (1859–1925) in eastern Nepal in 1901 was cited as the best specimen. It was illustrated by Ward (1903:438), and is still known to exist (fig. 3).

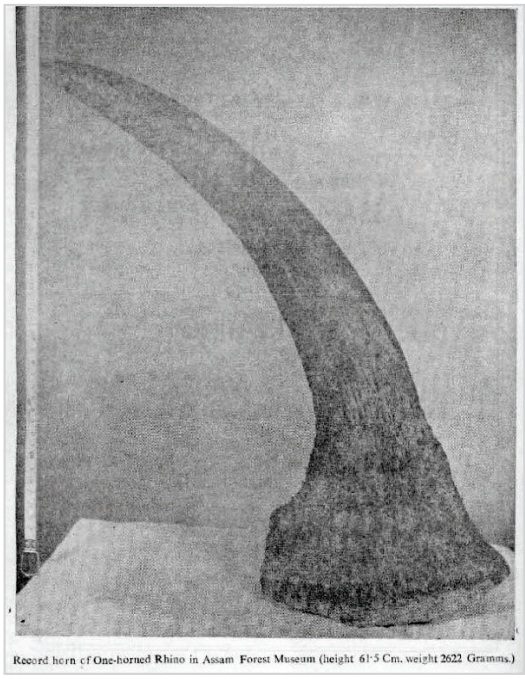


Figure 2. Horn of *Rhinoceros unicornis*, said to be 61.5 cm, once in the Assam State Museum (the original of this photograph published by Barua & Das 1969 is unfortunately quite vague).

A horn of 61.0 cm (in dry state) or 61.6 cm (in the field) was obtained by Thomas Charles Briscoe (1857–1909) in Assam in 1909. This record horn is preserved in the Natural History Museum, London (no. ZD.1910.1.23.1); and was often illustrated in the press (fig. 4).

Discussion

The data published for the extremely large specimens of *Rhinoceros unicornis* in the wild don't provide information on sexual dimorphism, as the sex of the animals was rarely recorded. In Cooch Behar, the largest male exceeded the largest female in dimensions, but this is not necessarily a general characteristic. Measurements of zoo animals may not be representative for a wild population due to changes of feeding.

This study was not concerned with minimum measurements. Taking those from the general literature, the following ranges for measurements can be suggested:

Length of body	300–436 cm
Height at shoulder	140–206 cm
Girth	250–380 cm
Horn	Up to 61 cm

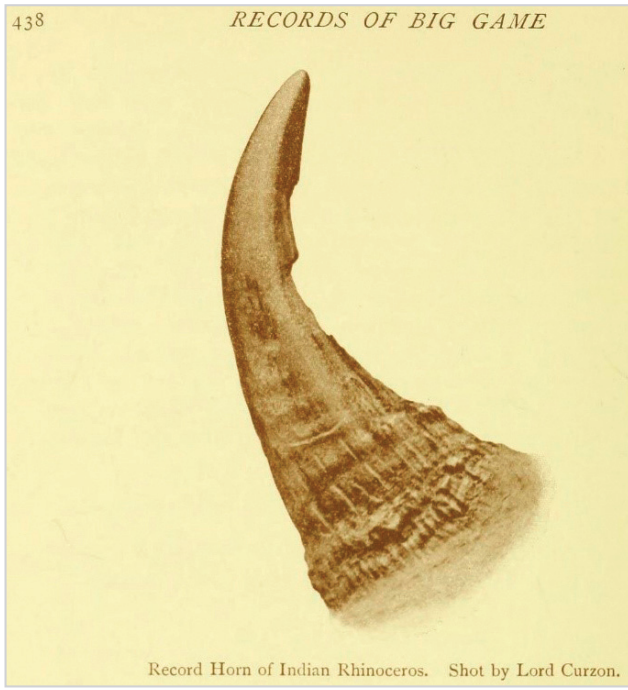


Figure 3. Horn of 54 cm, from a specimen of *Rhinoceros unicornis*, shot by Lord Curzon in East Nepal in 1901.



Figure 4. Horn of 61 cm, from a specimen of Rhinoceros unicornis, shot by Thomas Briscoe in Assam in 1909, the longest trophy still known to exist (from Barclay 1938).

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