

BIBLIOGRAPHY OF THE RHINOCEROS

*An analysis of the literature on the recent
rhinoceroses in culture, history and biology*

by

L.C.ROOKMAAKER



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*To my mother, the memory of my father,
my sister and my brother*

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INTRODUCTION

Much has been written about rhinoceroses. The present bibliography lists 3107 references to publications containing some information about the five living species. Since only a very few monographs have been published, most data must be sought in short papers or in more general books and articles. During the past few years, interest in rhinoceroses has increased, partly because all species are threatened with immediate extinction. Much, however, remains to be learned as most research until recently has been accidental rather than intentional. The first long-term field study, for instance, was made less than twenty years ago.

My own interest in the rhinoceros began some 15 years ago, in 1967. I decided then, with youthful naiveté (being 14 years old at the time), to collect and study 'everything concerning the rhinoceros'. Many hours and days of my spare time were devoted to this task, first in addition to my home work at secondary school, and later in between lectures and courses of my study of biology at the Free University in Amsterdam and at the University of Utrecht. It has been a source of great enjoyment to retrieve even small contributions on rhinoceroses in often unexpected places, to consult obscure books or uncut periodicals, and to correspond and meet with others equally interested in some aspect of rhinocerotology. I have often been surprised about the ubiquity of the rhinoceros. It is just everywhere, not merely in national parks, zoological gardens or museums. I also encountered its likeness in the Jardin des Tuileries of Paris, on the floor of the San Marco in Venice, in the arms of a part of the city of Siena, in house no. 38 of Ulica Grotzka in Cracow, on the crest of the Wade family at Snowhill Manor, as a popgroup and as a political party in Canada 'Rhinoceros', in chains on the steps of the Batsala Devi temple near Kathmandu, on the Rs.100 note of Nepal, on signs of Assam Oil, on stamps and in cartoons and children's books, just to name a few. Tim Clarke of London has always provided me with many references to the rhinoceros in art while doing his own research, and it is a pity that only small parts of his comprehensive documentation have yet been published.

Scholarly study of literature seems hardly popular nowadays. Students start their research projects with the obligatory but rapid search through recent volumes of some appropriate bibliography. Other scholars sometimes merely read some literature in order to include it in their introductions to a research paper. Biologists seem to assume that the generally laborious library work is all but a waste of time. Due to today's methods, it is notoriously difficult to publish any but the shortest literature surveys or to obtain grants for such work. Yet, such reviews often can give much insight and information to others busy with the interpretation of new data. I believe that much can be learned from the efforts of our predecessors and that reviews of their work are not only historically interesting, but also a valuable asset to original research. Happily, I am not alone in this view and one must hope that the pendulum will one day swing back and that the significance of bibliographic work

besides original research will again be understood.

This bibliography tries to list all literature on the five recent species of rhinoceros in all aspects, whether cultural, ethnological, historical, art-historical, parasitological or biological. It includes, however, only publications which I could consult personally resulting in some unavoidable omissions. It is certainly not a complete list, although I would be surprised if it would not cover at least some 75% of the literature on rhinoceroses published between 1500 and 1982. The analysis of the contents of the listed titles should, hopefully, enable future workers to identify earlier contributions to their particular field of interest.

Criteria of inclusion

The initial aim was to present everything published about rhinoceroses. Obviously this could not be achieved. As I have only included publications available to me, some pertinent references may have been excluded either because I was not aware of their existence or because I was unable to find them in a library. Some comments on various points may be made here.

Date: The last entries were made during the first half of 1982. It is interesting to look at the distribution of the included titles through time:

1500-1599	1.0%	1850-1899	15.2%
1600-1699	2.5%	1900-1949	24.7%
1700-1799	3.9%	1950-1982	47.3%
1800-1849	5.4%		

Remarkably, almost half of the entries appeared during the last 32 years. This may partly be attributed to personal bias, but it also seems to indicate that studies (and interest) of rhinoceroses are increasing.

Edition and translation: Usually I have made no attempt to study the first edition in the original language of a certain work or to check different editions of the same book. This bibliography always only cites the earliest edition which I have consulted, except when later editions contained important additional information. When appropriate, the date of the original first edition is provided in parentheses at the end of the entry.

Language: The majority of titles appeared in one of the (West European) languages which I am able to read. Publications in other languages are included, but they are rather few in number. Popular papers are most likely to be present if they were written in Dutch or English. The distribution is as follows:

English	61.2%	Dutch	8.7%
German	15.1%	Latin	3.9%
French	9.1%	Others	2.0%

Subject matter: There is no restriction as long as the publication contains information about some aspect involving a living species of rhinoceros. This bibliography, however, was prepared by a biologist with an historical interest. Therefore, publications about some (to me) marginal subjects are likely to be underrepresented, e.g. paleontology, parasitology, veterinary biology, microbiology, art history, ethnology, etc.

The massive literature on fossil rhinoceroses is generally excluded. I have, however, included references to extinct subspecies and to the prehistoric distribution of the living rhinoceroses, and to works with extensive morphological comparisons with the living species. It is unlikely that these categories have been

fully covered and the present list can only serve as a start for someone interested in this field.

Type of publication: Excluded are, with few exceptions, articles in newspapers and news magazines, separately published annual reports, guide books of museums and zoological gardens, and catalogues of art museums. Popular papers (e.g. in magazines published by zoological gardens) probably are badly represented proportionally because they are rarely cited and absent from most libraries.

Unpublished reports: It is a regrettable development that the citation of 'unpublished reports' in lists of references is increasing. These works cannot readily be referred to by the average reader. I have encountered difficulties in procuring copies of some very recent reports, even after correspondence with the author or the issuing body. I can only imagine the frustration which these reports will cause to a serious student after a lapse of several years, when the author moved or deceased, or when the responsible organisation has ceased to exist. I have reluctantly included some reports, only if I could obtain a copy, if they are of primary interest, and if they are not superseded by a proper publication by the same author.

The use of the Analysis

The 'Analysis of the literature' is divided into three parts. Part 1 (Chapters 1-3) contains references to the literature published before 1800 and to later titles on the knowledge of the rhinoceros in the western tradition from classical times to 1800. Part 2 (Chapters 4-9) includes the biological literature on the family Rhinocerotidae and the five living species. Part 3 (Chapters 10-17) analyses the role of the rhinoceros in African and Asian cultures and in the western culture after 1800.

Each chapter is divided into a large number of sections. When searching for a particular subject, one can either consult the table of contents or the index. Each section contains one or more references to publications about that particular subject, the full title of which is found in the bibliography. In most cases, one finds the names of the authors, the year of publication and the page-number, often followed by a remark in parentheses. These are intended to give a very brief further indication of the content of that title within the framework of that particular section. These indications in parentheses usually follow the spelling and style of the original publication (e.g. Rhodesia has not been changed into Zambia or Zimbabwe, etc.). My own personal comments are always preceded by the indication 'Note.'. Some sections contain a rather large number of references and, of course, not all of these may be particularly interesting. One could either try to start with a title which is easily available or published recently, or one could look for publications labelled 'review' (often gathered at the beginning of a chapter or section) which may be comprehensive studies on that subject or useful summaries of the older literature.

The bibliography

The citation of the titles in the bibliography follows the style generally adopted nowadays in biological journals. All names of authors are given in full without the use of square brackets, even if the work is signed only by initials. Names including a particle are always transposed in the case of the first author. The Dutch ij is alphabetized as y; the ü and ö as ue and oe.

Dates are those printed on the cover or title-page of the publication itself. Many issues of magazines dated for the last months of the year often did not appear until the first months of the next year, which is only retrievable in exceptional cases. The actual date of publication is only ascertained if the difference is significant in the

framework of rhinoceros studies (mainly for purposes of nomenclature).

Titles of books are cited in full, except (as in some early books) when the title bears resemblance to a table of contents. In those cases the title has been conveniently abbreviated. The title of a book is followed by edition and volume number, and the number of pages. Only the number of the final page is provided, e.g. 'pp.i-xx, 1-200' becomes ':xx, 200'.

ACKNOWLEDGEMENTS

It is quite impossible to mention all those who have enabled me to pursue my interest in the rhinoceros during the past fifteen years. Many helped by sending reprints of their papers or odd pieces of information, or just by accepting my idiosyncrasies. I owe much to several others who are actively engaged in the study of the rhinoceros and who have been exceptionally patient in listening to my questions or theories, or very generous with their results. Together they constitute a large part of the present (very) invisible college of rhinocerotologists: Markus Borner, A.J.E. Cave, Tim H. Clarke, Rod Flynn, Colin P. Groves, Claude Guérin, D.A. Hooijer, H.G. Klös, E.M. Lang, Andrew Laurie, Richard J. Reynolds, R. and L. Schenkel, and Nico van Strien. I have also been helped by B. Brentjes, K.A. Kitchen, Dennis R.H. Levy, Florence Pieters, Herman Reichenbach and Lothar Schlawe. This research certainly would never have been possible without the often timely encouragement and support by Peter J.P. Whitehead, Rob Visser, Peter J.H. van Bree and P. Smit. The latter have also actively assisted in obtaining a grant for publication of the present work.

A study of literature is never possible without the help of libraries which place their resources at disposal to the public. Among those where I have enjoyed hospitality, I especially want to mention the Artis-Library in Amsterdam, where I always had open access to the complete collection since my first visit sometime in 1966. Other research was done in a large number of institutions in Amsterdam, Bombay, Glasgow, Haarlem, The Hague, Johannesburg, Leiden, London, Paris, Utrecht and Wageningen.

Finally, I would never had the time or means to continue my work without the indulgence, support and assistance of my parents, my brother Hans and my sister Marleen. It is, therefore, a pleasure to dedicate this book to them.

ABBREVIATIONS

arr.	arrived
ct.	conter
col. cols.	column(s)
dt.	district
ed. eds.	edition(s), editor(s)
ff.	and following
fig.	figure
G.R.	Game Reserve
n.d.	no date
N.F.	Neue Folge (=N.S.)
N.P.	National Park
N.S.	New Series
p. pp.	page(s)
par.	paragraph
pl.	plate
prov.	province
R.	river, <i>Rhinoceros</i>
unpag.	unpaginated
vol.	volume

ANALYSIS OF THE LITERATURE

PART I

HISTORY

CHAPTER I
ANCIENT GREECE AND ROME

1.1 REVIEW

Gowers 1950 (review of most sources). Gunther 1967: 14 (summary). Keller 1909: 383-388. Killermann 1908: 581. Lach 1970: 158 (summary). Lenz 1856: 198 (sources cited). M. Ryhiner 1952. Steier 1895 (good succinct review). Stricker 1881. Toynebee 1973: 125-127, 368.

1.2 APPEARANCE

Aelianus, XVII.44 (horn sharp and hard; thick skin). Agatharchides, 71 (size, thick skin, colour, one horn). Aristoteles, Hist. Anim. 499b-19 ('Indian ass', one-horned and one-hoofed), Part. Anim. 663a ('Indian ass', one-horned, solid hoof). Dio Cassius, LI.22 (like elephant, with horn). Diodorus, III. 35 (size, thick skin, colour, one horn). Martialis, XXII (double horn). Oppianus, II. Plinius, VIII. xxix (size, colour, one horn). Strabo, XVI. 4, 15 (size, colour, one horn).

1.3 DISTRIBUTION

1.3.1 *Reports from Africa*

Agatharchides, 71 (around Red Sea). Herodotus, IV. 191 (horned asses in Scythia). Pausanias, IX. xxi (Ethiopia). Periplus, IV, VI (1980: 20, 22) (interior, occasionally around Adouli). Solinus, 43 (Ethiopia). Strabo, XVI.4, 15 (N.E. Africa).

1.3.2 *Reports from India*

Ctesias, 25 ('wild asses' in India: appearance, colour, virtues of horn; presence of ankle-bone and gall). Curtius, VIII. ix. 16 (India), IX. i. 5 (Persia). Diodorus, III.35 (India). Megasthenis, XV (one-horned horse in India). Philostratus, III. 2 (1883: 109) (India, only hunted by king; virtue of horn). Pseudo-Callisthenes, III. 16-17 (1969: 126) (after victory against Darius, king of Persians, 'great rhinoceroses came forth from the forest of reeds').

1.3.3 *Remarks*

On Aelian: Benveniste 1929 (Aelian's unicorn passage influenced by Indian rhinoceros).

On Ctesias: Ettinghausen 1950: 99 (first statement on antipoisonous virtue). Godbey 1939: 268. Heeren 1805: 965-969 (unicorn of Ctesias is Asiatic rhinoceros). Keller 1887: 186 (rhinoceros confused with '*Antilope picta*'). Lassen 1852: 646 (wild ass is rhinoceros). Laufer 1914: 90 n. 1, 97 n. 2, 154 n. 2. Steier 1895: 1781 (wild ass is rhinoceros with touches of other species; germ of unicorn legend). Wilson 1836: 48-55 (rhinoceros plus gorkhar).

1.4 HABITS AND LEGENDS

1.4.1 *Copulation*

Solinus, 30 (copulates backwards).

1.4.2 *Enmity with elephant*

Aelianus, XVII.44. Agatharchides, 71. Diodorus, III. 35 (fight for pasture). Plinius, VIII. xxix. Solinus, 43. Strabo, XVI. 4. 15 (fight for pasture, horn as weapon).

1.4.3 *Horn sharpening*

Aelianus, XVII.44. Agatharchides, 71. Diodorus, III.35. Plinius, VIII. xxix. Solinus, 43.

1.4.4 *Tossing of bear*

Martialis, XXII.

1.4.5 *Remarks*

Ettinghausen 1950: 76-90 (legends of movable horn, horn sharpening, enmity with elephant of Indian, not African, origin). Laufer 1914: 84 n.1 (horn sharpening). Scullard 1974: 227 (Aelianus on enmity with elephant).

1.5 EXHIBITION IN ROMAN CIRCUS

Athenaeus, V.201c (Alexandria, Ethiopian rhinoceros in procession for Ptolemaeus Philadelphus, 279.8 B.C.). Capitolinus, Ant. Pius, X.8-9 ('rhinoceroses' in Rome, 148-9). Capitolinus, Gord. III, xxxiii (one shown, April 248). Dio Cassius, LI. 22 (one slain by Caesar, 29 B.C.). Lampridius, XXVIII. 3 (one in Rome, described as 'Egyptian'). Martialis, IX, XXII (games of Titus, 80 A.D.). Plinius, VIII. xxix (one in games of Pompey the Great, 55 B.C.; it has 'often been seen'; 'another bred here to fight...'). Solinus, 43 (first rhinoceros in Rome during Gn. Pompejus). Suetonius, II.43. 3 (one at Saepia during reign of Augustus).

Remarks: Colesso 1701. Cuvier 1806: 26. Fitzinger 1836. Freytag 1747: 34. Godbey 1939: 266, 267. Gowers 1950. Hediger 1938: 1873 (Titus, 80). Houuttuyn 1761: 330. Jennison 1937: 30, 54, 66, 72, 84, 86, 87, 90, 92. Keller 1887: 149 (Alexandria). Ladvocat 1749: 20. Laurie 1978b: 2. Loisel 1912, I: 92, 103-108. Oken 1838: 1189. Reynolds 1963a: 99 (black rhinoceros), 1971: 13. Toynbee 1973: 126.

1.6 TRADE

Iuvenalis, VII. 130 (horn used as oil-flask in Roman baths). Periplus, VI, XVII (1980: 22, 31) (export from Africa).

Godbey 1939: 263-265 (trade with Africa and China). Herrmann 1913: 556 (trade between China and Africa, or Huang-tschì). Warmington 1974: 162 (horn imported into Rome from India and Africa; also taken to China).

1.7 ART

1.7.1 *Review*

Sperlich 1961

1.7.2 *Piazza Armerina, Sicily (mosaic, N.W. of Syracuse)*

Gentili 1957: 221 ('hunters drag a rhino from an African swamp'). Sperlich 1961: 138 (Indian rhino). Toynbee 1973: 127, fig. 1 (African mosaicists, ca. 305 A.D.).

1.7.3 *Cameos*

Furtwängler 1896: 305, 311 (two cameos). Imhoof-Blumer & Keller 1889: 121, pl. XIX 46 (Berlin, 1 cameo).

1.7.4 *Coins*

Augustin 1587, pl. 63 (Domitian, two-horned rhinoceros). Camper 1782: 140 (Domitian). Gowers 1950: 69 (Domitian and Hadrian). Imhoof-Blumer & Keller 1889, Pl. IV 8 (Domitian). Lach 1970: 160 (Caracalla, one-horned rhinoceros). Mattingly 1976: 411, pl. 81. 16-17 (Domitian). Rookmaaker 1978b: 20 (Domitian). Sloane 1749: 124, figs. 6-7 (Domitian). Spanheim 1671: 137 (Domitian, with one-horned rhinoceros). Toynbee 1973: 126, pl. 52 (Domitian).

1.7.5 *Labicum, Thonlampe*

Keller 1887: 118, fig. 28. Laufer 1914: 85 n.1.

1.7.6 *Palestrina mosaic, Praeneste*

Barthelemy 1761: 592 ('l'arrivée de l'empereur Hadrian dans un canton de la haute Egypte'). Camper 1782: 141. Gowers 1950: 68. de Montfaucon 1757: 151, 159 (by Sylla). Shaw 1746: 91. Toynbee 1973: 126 (triumph in Fortuna temple, by Sulla). Volkman 1779: 336 (time of Hadrian).

1.7.7 *Perugia mosaic*

Gowers 1950: 68 (white rhinoceros from time of Augustus).

1.7.8 *Salmanassar II obelisk*

Benveniste 1909. Brentjes 1978: 151 (ox). Hiltzheimer 1926: 166. Keller 1909: 386, fig. 133 (rhinoceros). Laufer 1914: 87 (rhinoceros). M. Ryhiner 1952: 66 (is rhinoceros).

1.7.9 *Tesserae*

Gowers 1950: 68 (rhinoceros is not Indian). Rostovtsev 1903 (some figured).

1.8 OTHER STATEMENTS

Horatius, I.5 (Sarmenus compares Meurius with a 'wild horse' with a horn). Lucilius, III.135 (mentions 'rhinoceros').

1.9 SPECIES KNOWN TO ROMANS

Gowers 1950 (most specimens shown in Rome were *Ceratotherium simum cottoni*). Jennison 1937: 34, 54, 74 (often Indian, sometimes African species). Loisel 1912, I: 136 (both one and two-horned species known). Rookmaaker 1978b: 20 (*Rhinoceros unicornis* and *Ceratotherium simum*). Toynbee 1973: 125-127 (both one and two-horned species known). Warmington 1974: 150 (both one and two-horned species known).

CHAPTER 2

MIDDLE PERIOD (400-1500)

2.1 REVIEW

d'Alès 1936 (on Tertullian and Justin, symbolism). Einhorn 1976 (on unicorn, occasional information on or parallels with rhinoceros study). Godbey 1939: 286-290. Sainéan 1921: 39 (names).

2.2 GENERAL SOURCES

Abelaerdus, col. 1806 (poem). Cosmas, XI, col. 441 (India and Ethiopia). Eucherius, p. 820 (double-horned rhinoceros distinct from monoceros). Eustathius, cols. 743, 955 (mentions monoceros). Gossouin 1913: 114 (a 'monoheros' among Indian animals -cf. Langlois 1911: 83). Isidorus, XII, ii. 12, 13 (rhinoceros is monoceron, captured by virgin). Jordanus 1863: 18 (rhinoceros of India is not unicorn). Langlois 1911: 35 (Bestiaire by Philippe de Taon, 12th century, describes monoceros). Photius, col. 477, cap. 36 (describes rhinoceros). Polo 1958: 188, 253 (unicorn in S.E. Asia). Tertullianus 1927: 144 (monoceros differs from one-horned rhinoceros; symbolism of unicorn). Timotheus of Gaza 1949: 44 (chapter on rhinoceros, partly from Oppian).

2.3 TRANSLATION OF JOB 39 VERSE 9

Alanus, col. 927 (translates rhinoceros = unicornis). Augustinus, col. 881, cap. 39 (monoceros is unicornis). Bruno, col. 679, cap. 39 (translates rhinoceros). Gregorius, col. 571, cap. 31.2 (translates rhinoceros, with symbolism). Hieronymus, col. 1462, cap. 39 (translates rhinoceros = unicornis). Odonis, col. 461 (translates rhinoceros = monoceros). Rupertus, col. 1169 (translates rhinoceros; symbolism).

2.4 PHYSIOLOGUS

Carmody 1939: 31 (Latin physiologus, 4th century, chapter on Unicornis). Laufer 1914: 110-114. Maurer 1967 (German physiologus, chapter on unicorn). Strzygowski 1899: 18, 28 (Greek physiologus, ca. 1100, chapter on unicorn, taken from Cosmas).

CHAPTER 3

PUBLICATIONS BETWEEN 1500 AND 1800

3.1 CONTEMPORARY REVIEWS

Anon. 1765: 251. Aldrovandi 1621: 886-889, 1623: 190. Bochart 1663: 313. Freytag 1747. Gessner 1551: 956 ff., 1563. Gois (1566) 1955: 52. Jonston 1660: 79. Ladvoat 1749: 29. Mauro 1556: 246. du Molinet 1692: 192. Pennant 1771: 75, 1781: 136. Ruysch 1718: 66. Topsell 1607: 594. Vossius 1700: 378.

3.2 NAMES

Bruce 1790: 90. Buffon & Daubenton 1764: 174. Freytag 1747: 5-7. Gessner 1553: 30. Houltuyn 1761: 329. Klein 1751: 26. Kolb 1727: 189.

3.3 CLASSIFICATION

3.3.1 *Review*

Rookmaaker 1981, 1982.

3.3.2 *Interpretation of Martial's Epigram*

Review: Rookmaaker 1976b, 1981.

Bochart 1663: 313-315 (critical review; emendations of text). Calderinus & Merula 1601: 19 (rhino double-horned). Camerarius 1595: 6. Camper 1782: 135-140. Colesso 1701: 14. Duke 1739: 3. Freytag 1747: 23-26. Grew 1681: 30 (rhino cannot throw a bear). H.D. 1768. Parsons 1743: 536, 1766. Peyerus 1685: 43-46. Politianus 1524: 69. Raderus 1611: 56 (rhino double-horned). Scaliger 1576: 659. Schroeckius 1686. Scriverius 1629: 11 (ursum as 'urum'). Sloane 1749: 124, pl. 2. Vossius 1700: 378 (after Scriverius).

3.3.3 *Relation with unicorn*

Rhinoceros is unicorn: Duke 1739: 1. Kircher 1675: 59. Klein 1751: 29. Ladvoat 1749: 23-25 (rhino is a kind of unicorn).

Rhinoceros is not the unicorn: Andersen 1696: 11. Drusius 1636: 881. Franzius 1643: 73. Hoffmann (1680) 1931: 31. Hubrigk 1660, par. 13. Pare 1604: 625. Schoutens 1676: 124. Vater 1679, par. 8.

Remarks: Einhorn 1976. Günther 1967. Laufer 1914: 110-113 (unicorn not based on rhino). Lucas 1920: 534 (rhino horn used as that of unicorn). Shepard 1967.

3.3.4 *Translation of biblical passages*

Anon. 1780 (re'em is rhino). Barth 1747 (rhino in Job). Brentius 1527: 305 v-306r

(translates Rhinoceros). Bruce 1791: 87-92. Camper 1782: 141-145 (re'em is rhino). Deusingius 1659: 7. Drusius 1636: 881 (review). Houttuyn 1761: 327. Pererius 1606: 998 (Deut. 33, 'rhinoceros'). Reinhard 1748: 6 (Job's re'em is not rhino). Scheuchzer 1721: 388, 1731: 21 (Job 39, 'rhinoceros'). Schultens 1742: 267 (Job 39, *Bos sylvestris*, not rhino). Schultens & Muntinghe 1794: 171 (ox, not rhino). Shaw 1746: 91 (re'em is rhino).

Remarks: Anon. 1872: 314 (re'em is rhino). Godbey 1939 (rhino and unicorn in Bible and Talmud). Killermann 1908: 581. Layard 1849: 429 (interpretations of re'em). Lewysohn 1858: 149 (re'em in Talmud). Robin 1932: 74-80 (unicorn in Bible).

3.3.5 Discussion on number of species

Anon. 1814: 642. Allamand 1781: 10 (Cape rhino, double-horned). Barbier (1749) 1857, IV: 356 (sexual difference in number of horns). Barth 1747 (review on number of horns). Beckmann 1766: 129-131 (2 kinds). Boddaert 1785: 162 (Indian and African species). Brink 1778: 38 (constancy of double horn uncertain). Bruce 1790: 85, 1791: 105. Buffon 1778: 134 (number of horns variable). Buffon & Daubenton 1764: 186 (distinction on horns uncertain). Camper 1780, 1782 (Indian and African species). Cuvier 1797, 1798 (at least 2 species). Duke 1739: 4 (rhino single-horned, second horn is 'a redundancy in an individual'). Edwards 1758: 25 (double horn an accidental sport of nature or race). Freytag 1747: 23-30 (review). Gmelin 1767 (number of horns depends on age). J.F. Gmelin in Bruce 1791: 23 (probably one species). H.D. 1768 (existence of double-horned rhino). Houttuyn 1761: 329, 346 (African and Indian species). Jonston 1655: 98 (one or two horns). Kerr 1792: 113, 114 (*R. unicornis* and *R. bicornis*). Klein 1751: 30-32, 1760 (2 species or 2 varieties). Kolb 1719: 160, 1727: 189. Labat 1732: 169 (species according to number of horns). Lacépède & Daudin 1802: 39 (Buffon described, *R. unicornis* and *R. bicornis*). Ladvocat 1749: 12, 31 (2 species). Linnaeus 1758: 22 (*R. unicornis* and *R. bicornis*). 1766: 104 (one species with 2 varieties). Merck 1786. Meijer 1793: 104 (2 kinds). Pallas 1769: 451, 1780 (discussion on number of species). Parsons 1743: 537, 1766 (2 kinds). Pasteur 1793: 50 (both sexes have two horns). Pennant 1771: 75, 1781: 136-140 (African and Indian species). Shaw 1800: 198-207 (single-horned, double-horned and Sumatran species). Sloane 1749: 119.

3.4 MORPHOLOGY

3.4.1 Description of appearance, 16th century

Aneau 1552: 17 (see Nais 1961: 251). Camerarius 1595: 5. Cardanus 1559: 404. da Cruz (1569-70) in Boxer 1953: 77. Gessner 1551: 956-958. Jovius 1571: 362. Munster 1554: 1086. Pare 1573: 577. Rabelais (ca. 1550) in Sainéan 1921: 38. Salomon 1943: 498. de Sande 1590: 208. Scaliger 1576: 659. Thevet 1557: 40. Varthema (1510) 1928: 22.

3.4.2 Description of appearance, 17th century

Andersen 1696: 11. von der Behr 1689: 30 (after Merklein). le Blanc 1654: 137. Boillot 1604. Bontius 1642: 16, 1658: 50. Calderinus & Merula 1601: 11. Dapper 1668: 21. Deusingius 1659: 7. de Flacourt 1661: 394. Franzius 1643: 73. Gervaise 1688: 33. Grew 1681: 29. Hoffmann (1680) 1931: 31. Hubrigk 1660, par. 13. Jonston 1632: 327. van Linschoten 1644: 70. Lonitzer 1679: 609. Merklein (1663) 1930: 13. Nieuhof 1665: 93. Pare 1604: 625. Pererius 1606: 998. Pommet 1694: 26. Ray 1693:

122. Saar 1672: 19 (after Merklein). G. Schott 1662: 1084. Schoutens 1676: 124. Schreyer (1681) 1931: 26, 59. Schroeckius 1686. Tachard 1687: 76. Topsell 1607: 594. Valerianus 1631: 26. Worm 1655: 336.

3.4.3 Description of appearance, 18th century

Anon. 1777: 399-407. Allamand 1781, 1782, 1785 (Cape). Barth 1747. Bell 1793 (Sumatra). Biron 1703: 183. Boddaert 1785: 162 (*R. unicornis*, *R. bicornis*). Buffon 1778: 133. Buffon & Daubenton 1764: 174-191. Bonannius 1773: 16. Brink 1778: 37 (Cape). Brisson 1756: 113. Bruce 1790: 93-95. Camper 1780, 1782 (Cape rhino, head and skull). Chardin 1711: 45. Duke 1739: 4-8 (after Grew). Edwards 1758: 24. Freytag 1747: 12-30 (from older authors). Hamilton (1727) 1930: 16. Houttuyn 1761: 329, 330-349. Klein 1751: 26-28. Kolb 1719: 159, 1727: 189. Labat 1732: 169. Ladvocat 1749: 3-8. Leguat 1708: 146. Levaillant 1795, III: 57. Linnaeus 1758: 56. Lobo 1728: 230. Mentzel (1785) 1921: 27. Pallas 1769: 451-455. Parsons 1743: 529-536; 1766 (horn). Pennant 1771: 75, 1781: 136, 138. J. Ray in Derham 1718: 262 (quadrisulc). Scheuchzer 1721: 389. Schwartz 1751: 51. Sparrman 1778, 1779, (1787) 1977: 80-87 (Cape). Thunberg 1792: 262 (Cape). Turpin (1771) 1811: 619. Vogel 1716: 329.

3.4.4 Impenetrable skin

Biron 1703: 184. Bontius 1642: 16, 1658: 50. Buffon & Daubenton 1764: 185, 195. Dapper 1668: 21. de Flacourt 1661: 395. Gervaise 1688: 34. Hoffmann (1680) 1931: 31. Nieuhof 1665: 93. Pennant 1771: 75. van Riebeeck 1952, I: 268. Shaw 1800: 200. Sparrman (1787) 1977: 87-89. Tachard 1687: 77.

3.5 DISTRIBUTION

3.5.1 Reports from Asia, 16th century

Roger Barlow (1541) in Taylor 1932: 112 (India). Gaspar da Cruz (1569-70) in Boxer 1953: 77 (Cambodia). Nicolo Conti (15th century) in Major 1857: 13 (India). Juan Gonzalez de Mendoza (1585) in Staunton 1854: 311 (Cambodia). Munster 1554: 1086 (India). da Orta (1563) 1895: 74 (India). Thevet 1575, I: 403a ('Royaumes de Camut & Macim').

3.5.2 Reports from Asia, 17th century

Andersen 1696: 11 (Java, Sumatra, Bengala, Siam). von der Behr 1689: 30 (Java). le Blanc 1654: 137 (Bengale, Patane, Macharane). Bontius 1642: 16, 1658: 50-52 (Java). Borri 1633, cap.4 (Cochin-China). Choisy 1687: 290, 369 (Conresuma, Siam). Dapper 1670: 230 (Suchuen, Quang Si). Gervaise 1688: 33 (Siam). Godinho de Eredia (1613) 1882 (Malacca). van Goens (1656) 1856: 313 (Java). Grew 1681: 30 (Bengale, Patane). Herport (1669) 1930: 31 (Java). Jacobaeus 1696: 4 (Bengala, Cambaja, Malacca, Sumatra, Siam). Jonston 1655: 98. van Linschoten 1644: 70 (Patane, Bengal). Merklein (1663) 1930: 13 (Java). Nieuhof 1665: 93 (Suchuen). Olearius 1696b: 144, 147 (Java). Philippe 1669: 371 (Bengale). Pyrard 1619, I: 354 (Bengal). Gabriel Quiroga (1604) in Cabaton 1914: 94 (Cambodia). Ray 1693: 123 (Bengale, Patane). Saar 1672: 19 (Java). Schoutens 1676: 124 (Patane, Queda, Perach, Java, Bengal). Tavernier (1676) 1977, II: 225 (Siam), 250 (Achin). de Thevenot 1666: 25 (India). de Vries 1682: 1200 (Java).

3.5.3 *Reports from Asia, 18th century*

Bell 1793 (Sumatra). Bruce 1790: 86 (India). Buffon & Daubenton 1764: 190 (Bengal, Siam, Laos, Mogol, Sumatra). Carletti (1701) 1964: 159 (Cochinchina). Duhalde 1736: 243 (Quang Si). Duke 1739: 4 (Bengal, Patava, Jacatra). Freytag 1747: 7-12 (Bengal, Cambaia, Patane, India, Assam). Houttuyn 1761: 330 (East Indies, China, Great Mogol, Bengal, Borneo, Sumatra, Java). Kerr 1792: 113 (Bengal, Siam, Cochin China, China, Java, Sumatra). Ladvoat 1749: 10 (different countries). Leguat 1708: 93 (Java). Linnaeus 1758: 56 (India). de Mandelslo 1727: 376 (Java, Bengal, Patane). Pennant 1771: 76, 1781: 139 (different countries). de Rennefort 1702: 482 (terres de Mogol). Rumphius 1705: 294 (Java). Schwartz 1751: 51 (Java). Turpin (1771) 1811: 329 (Sumatra). Zimmermann 1777: 377 (different countries).

3.5.4 *Reports from Africa, 16th-17th centuries*

Review: Forbes 1977: 35 (van Riebeeck, van der Stel). Raven Hart 1971, passim (17th century authors).

de Choisy 1687: 339 (Cape). de Flacourt 1661: 395 (Cape). Friek 1692: 33 (Cape, export ban). Herport (1669) 1930: 21 (Cape). Hoffmann (1680) 1931: 31 (Cape). Jonston 1655: 98. Ludolfus 1681, pars. 78, 79 (Aethiopia). Nieuhof 1682: 6 (near Cape). Ray 1693: 123 (Africa, Abassia). van Riebeeck 1952-57, I: 68, 169, 268, II: 182, III: 470 (Cape). Schreyer (1679) 1931: 26 (Cape). Tachard 1687: 76 (Cape). Thevet 1557: 40 (Cape of Good Hope).

3.5.5 *Reports from Africa, 18th century*

Anon. 1777: 400 (Cape, after Kolb). Allamand 1781: 9, 1785: 2, 5 (150 miles from Cape). Beekman 1718: 179 (Cape). Bogaert 1711: 104 (Cape). Brink 1778: 38 (Cape). Browne 1799: 260 (Sudan). Bruce 1790: 86 (Ethiopia). Buffon & Daubenton 1764: 191 (Abissinie, Ethiopie, Cape, country of Anzicos). Camper 1780: 193, 1782 (Cape). Freytag 1747: 9 (Aethiopia). Houttuyn 1761: 330 (Africa, Abyssinia, Ethiopia). Kerr 1792: 114 (Africa). Kolb 1719: 159, 1727: 189 (Cape). Labat 1732: 169 (Ethiopic, Congo). Ladvoat 1749: 10, 31 (Abyssinie, Cape). Leguat 1708: 145 (Cape). Levaillant 1795, III: 56 (Cape). Linnaeus 1758: 56 (Africa). Lobo 1728: 69 (Abissinie). Mentzel (1785) 1921: 25, 27 (Cape). Pasteur 1793: 152 (Cape, Abyssinia). Paterson 1790 (Cape, cf. Forbes & Rourke 1980). Pennant 1771: 76, 1781: 136 (Angola, Aethiopia, Cape). de Rennefort 1702: 306 (Cape). Sparrman (1787) 1977: 76-92 (Quammedacka). Thunberg 1792: 261 (Cape). Wintergerst (1712) 1932: 18 (Cape). Zimmermann 1777: 377 (different countries).

3.6 SPECIMENS IN MUSEUMS AND CABINETS

Unknown collection: Camper 1782: 152-155 (different specimens, mainly in Holland). Gmelin 1767 (Holland, skeleton). Klein 1751: 31 (Europe, horns). Kolb 1727: 189 (horn brought home). Parsons 1766 (London, double horn). Phipson 1883: 113 (description by Heywood 1638 of mounted rhino in pageant). Rookmaaker 1978b: 31 (England, ca. 1740).

Amsterdam: Jacobaeus 1910: 27 (one seen).

Augsburg, J.G. Micheliuss Schroeckius 1686: 468 (double horn).

Cape Town, Fort: Beekman 1718: 179. Hesse 1690: 30. Nieuhof 1682: 7. Schoutens 1676: 124. Wintergerst (1712) 1932: 19. (All referring to mounted animal.)

Copenhagen, Christian V: Jacobaeus 1696: 4.

Danzig, Lehmann: Houttuyn 1761: 348. Klein 1751, fig. I (double horn).

Darmstadt, J.H. Merck: Merck 1786 (skull D. bicornis).

Delft, Theatrum Anatomicum: Houtzager 1979: 57-61 (mounted rhino, arr. 1662, since 1667 leased to 2 men from Amsterdam). Jacobaeus 1910: 84.

Florence, Museum de Medici: Shufeldt 1893: 371 (16th century specimen, now museum Florence).

Groningen, University (from P. Camper): A. Camper 1809, 1811. Camper 1780: 193, 1782: 130. Merck 1786. Rookmaaker & Visser 1982 (horns described by Camper now unknown).

Leiden, J. Swammerdam: Swammerdam 1679: 36 (horns, teeth).

Leiden, University: Barge 1934: 58 (head of young rhino, Theatrum Anatomicum, 1622-1628). Gmelin 1767 (3 skulls). Rookmaaker 1976a: 88 (young rhino, arr. 1677, present 1739).

London, R. Mead: Sloane 1749: 124 (double horn).

London, Royal Society: Grew 1681: 29-31. Rookmaaker 1978b: 31 (skin possibly *R. sondaicus*).

London, H. Sloane (British Museum): Brooks 1954: 198, 200. Pennant 1781: 136, 138. Sloane 1749: 118 (double horn).

Paris, Cabinet du Roi: Buffon & Daubenton 1764: 189, 204-210.

Paris, St. Geneviève: Biron 1703: 184. du Molinet 1692: 192.

Rome, Museum Kircherianum: Bonannius 1773: 14 (horn).

Rome, Moscardo: Moscardo 1672: 243 (horn).

Uppsala, Royal Academy of Sciences: Sparrman (1787) 1977: 83 (horns).

Vienna, Rudolf II: Bauer & Haupt 1976: 4, 5, 141 (horns in 1607).

3.7 HABITS AND LEGENDS

3.7.1 *Copulation*

Buffon & Daubenton 1764: 184 (backwards). Camper 1782: 171-173 (not retromingens). Gessner 1551: 937 (coitus aversus). Ladvoat 1749: 6 (no generatio spontanea, against Oppian). Sparrman 1779.

3.7.2 *Edibility of meat*

Allamand 1785: 5. Bruce 1790: 104. Buffon & Daubenton 1764: 192. Houttuyn 1761: 351. Kolb 1727: 189. Ladvoat 1749: 15. Levaillant 1795, III: 60. Pennant 1771: 76.

3.7.3 *Enmity with elephant*

Aneau 1552: 17. Andersen 1696: 11. Boerhaave 1737: 153. Boillot 1604. Borri 1633, cap. 4. Buffon & Daubenton 1764: 193. Camerarius 1595: 6. Calderinus & Merula 1601: 11. Camper 1782: 174 (incorrect). Cardanus 1559: 404. Deusingius 1659: 9. Duke 1739: 8. Ferro 1623, II: 49. Franzius 1643: 74. Freytag 1747: 30. Gessner 1551: 958. de Gois (1566) 1955: 54. Goldsmith 1816: 359. Houttuyn 1761: 332-334. Jonston 1632: 327. Jovius 1555: 51, 1571: 362. Kircher 1675: 59. Kolb 1727: 189. Ladvoat 1749: 16-18. Lobo 1728: 69, 230. Lonitzer 1679: 609. Maffei 1590: 234. du Molinet 1692: 193. Munster 1554: 1086. Pare 1573: 577. Pennant 1771: 76. Pererius 1606: 998. Petri 1723: 121. Pomet 1694: 26 (plate p. 24). Schoutens 1676: 125. Thevet 1557: 40. Turpin (1771) 1881: 619. Valerianus 1631: 26. Vogel 1716: 330. Vossius 1700: 378.

3.7.4 *Food*

Barth 1747: 3. Bontius 1642, 1658: 51 (thorns, no meat). Bruce 1790: 95, 1791: 105. Buffon & Daubenton 1764: 193. Camper 1782: 176. Duke 1739: 8. Houttuyn 1761: 332. Kolb 1727: 189. Ladvoat 1749: 10. Nieuhof 1665: 93 (thorns). Parsons 1743: 529. Pennant 1771: 76, 1781: 137. Peyerus 1685: 46 (ruminating uncertain). Ray 1693: 123 (probably not ruminating). Vogel 1716: 329.

3.7.5 *Friendship with tiger*

Bontius 1642: 16, 1658: 50, 52. Buffon & Daubenton 1764: 193. Duke 1739: 10. Goldsmith 1816: 359. Pennant 1771: 76. Vogel 1716: 329. de Vries 1682: 1200 (after Bontius).

3.7.6 *Horn sharpening*

Aneau 1552: 17. Boillot 1604. Calderinus & Merula 1601: 11. Jonston 1632: 327, 1655: 98. Lonitzer 1679: 609. Munster 1554: 1086. Pare 1573: 577. Schoutens 1676: 125. Valerianus 1631: 26.

3.7.7 *Insects in folds of skin*

Edwards 1758: 26. Pennant 1771: 76, 1781: 139.

3.7.8 *Licking of enemies with tongue*

Allamand 1785: 5 (incorrect). Bontius 1642: 16, 1658: 51. Bruce 1790: 97 (soft tongue). Camper 1782: 177 (incorrect). Dapper 1668: 22. Goldsmith 1816: 359. Ladvoat 1749: 6, 11. Nieuhof 1665: 93. Pennant 1771: 76 (doubtful). Peyerus 1685: 46.

3.7.9 *Longevity*

Houttuyn 1761: 338. Ladvoat 1749: 8.

3.7.10 *Ploughing of ground with horn*

de Choisy 1687: 339. Tachard 1687: 77.

3.7.11 *Precedence at waterhole*

Andersen 1696: 11. van Linschoten 1644: 70. Pyrard 1619, I: 354.

3.7.12 *Senses*

Allamand 1781: 11, 1785: 4. Buffon & Daubenton 1764: 196. Houttuyn 1761: 336. Pennant 1781: 137.

3.7.13 *Temperament*

Bontius 1642: 16, 1658: 51 (attack in Java). Camper 1782: 176. de Choisy 1687: 339 (dangerous). Deusingius 1659: 9 (gentle unless angry). Gervaise 1688: 33. Houttuyn 1761: 336-338. Nieuhof 1665: 93 (gentle unless angry). Pennant 1771: 76. Pomet 1694: 26 (gentle). Saar 1672: 19. Schott 1662: 1084 (after Bontius). Schoutens 1676: 124. Shaw 1800: 200. Tachard 1687: 76 (malicious). Valerianus 1631: 26.

3.7.14 *Voice*

Allamand 1785: 9. Kolb 1727: 189. Ladvoat 1749: 9. Pennant 1771: 76.

3.7.15 *Wallowing*

Bruce 1790: 99-101. Buffon & Daubenton 1764: 190. Pasteur 1793: 141. Pennant 1771: 76.

3.8 VIRTUE OF RHINOCEROS PARTS

Allamand 1781: 11 (antipoisonous virtues incorrect). Andersen 1696: 12 (horn against poison). Biron 1703: 184 (medicine). Brink 1778: 38. Browne 1799: 261 (carried to Egypt, used for sabre-hilts and antidote against poison). Buffon & Daubenton 1764: 188, 192 (horn against poison and as medicine). Camper 1782: 156 (antipoisonous). Chardin 1711: 45. de Choisy 1687: 369 (rhino horns from Siam 'dont l'une vient d'un buffle'). Gervaise 1688: 34. Grim 1677 (successful use of horn to cure knee wound of R. van Goens). Hoffmann (1680) 1931: 31. Houttuyn 1761: 345, 351 (medicine, against poison). Kolb 1727: 189 (powder made from skin as medicine). Labat 1732: 170 (Africa, medicine and against poison). Ladvoat 1749: 14-16 (in India and Aethiopia). van Linschoten 1644: 70. de Mandelslo 1727: 377 (Java, use of flesh, blood, horn, teeth, skin and dung as medicine and against poison). Marggraf 1758 (salt made from skin, composition). Mentzel (1785) 1921: 28 (not antipoisonous). du Molinet 1692: 193. Pennant 1771: 76, 1781: 140 (India, horn medicinal and antipoisonous). Philippe 1669: 371 (discovers poison; often brought to Goa). Pomet 1694: 26. Redi 1671: 98, 1687: 113 (blood, horn and skin useless as medicine). Rumphius 1705: 294 (stone from brain against fever). Saar 1672: 19. Sloane 1749: 118 (stone from stomach or intestines). de Thevenot 1666: 25. Thunberg 1792: 261 (horn cups, no virtue). Turpin (1771) 1811: 620 (Siam).

3.9 CAPTURE AND TAMING

Allamand 1781: 12 (doubtful about taming). Bruce 1790: 102 (Chardin incorrect). Buffon 1778: 134. Buffon & Daubenton 1764: 189. Chardin 1711: 45 (tamed by 'Abessins', used for working). Goldsmith 1816: 361. Houttuyn 1761: 334-336 (capture). Ladvoat 1749: 18, 32 (capture by virgin). Schreyer (1679) 1931: 29 (traps by Hottentots).

3.10 THE FIRST LISBON RHINOCEROS 1515

3.10.1 *History - sources*

Albuquerque 1884a: 104; 1884b, 1898: passim. de Barros (1628) 1945: 422. Cardanus 1559: 404. de Cobarruvias 1611: 112r. Correa 1860: 373. Gessner 1551: 596. de Gois (1566) 1955: 55. Jovius 1555: 50, 1571: 362-364. Maffei 1590: 234. Moscardo 1672: 243 (stranded in Italy). Munster 1554: 1086. da Orta (1563) 1895: 75. Penni 1515. Sanfelicius 1571. Scaliger 1576: 659.

3.10.2 *History - remarks*

Review: da Costa 1937. Dodgson 1938: 46-51. Lach 1970: 161. Rookmaaker 1973c: 39-44.

Remarks: Anon. 1855 (after de Gois), 1872: 315. Barrington 1803: 253. Beckmannus 1766: 39. Boerhaave 1737: 154. Browne 1896: 3 (after Shufeldt). Buffon & Daubenton 1764: 190. Buys 1978: 106. Camper 1782: 137. de Castanheda 1833: 450-452 (arr. 1515). de Castilho 1956: 172. Clarke 1973: 2-3, 1975b: 35, 1976: 4. Cole 1953: 339. Coste 1946: 118. Dembeck 1965: 279. S. Dittrich 1975. Dodgson 1903: 307. Duke 1739: 4. Fitzinger 1836. Freytag 1747: 32, 36. Gowers 1952: 288. de

Gubernatis 1867: 168-171, 1875: 389-392 (letter by Valentino Marovia to Neuremberg 1515, in Italian; cf. da Costa 1937: 33-40). Hébert 1969: 143. Hediger 1938: 1872. Houtzager 1979: 57. Hufnagel 1873. Jeannin 1951: 128, 1962. Klein 1751: 28. Laufer 1914: 83-84. Laurie 1978b: 3. Lehmann 1952: 62-64. Lloyd 1971: 40 (arr. 1517). Loisel 1912, 1: 217-219. de Matos 1960: 387-390. Nais 1961: 147. Oken 1838: 1190. Ortelius 1887: 637 (anagram by Corequius). Pasteur 1793: 141. Petri 1723: 121. Ravenstein 1908: 2. Reinhard 1748: 6. Reinhard 1912: 749. Reynolds 1971: 13. Rieth 1974: 85. Rookmaaker 1980a: 67, 1982: 5. Ruffi 1696: 300 (Marseille, 22 Jan. 1516). M. Ryhiner 1952: 67. Salomon 1943: 499-501. Scheuchzer 1721: 389. Schneider 1959. Shufeldt 1893: 371 (specimen in Florence since 16th century). Stricker 1881. de Vaissière 1897: 193 (Marseille 1516-17). Yule & Burnell 1903: 363.

3.10.3 Illustrations published before 1800

Review: Cole 1953. Coste 1946.

Andreini 1617: 36 (in paradise). Bartholinus 1678: 172. von der Behr 1689: 1. Beslerus 1642, frontispiece. Boillot 1604. Bolling 1678, frontispiece. Gessner 1551: 957, 1553: 30. Guiard de Servigné 1750, frontispiece. Herport (1669) 1930, facing p. 20. Jonston 1655, pl. 38. Kircher 1675: 59 and following p. 116. Kolb 1719, pl. 4, 1727, I, facing p. 189. Ladvoat 1749, pl. 2. Leguat 1708, facing p. 146 (5 different rhinos). Lonitzer 1679: 609. Munster 1554: 1068, 1086. Nestor 1564: 174. Nieuhof 1665 (2): 93, 1682, map. Pare 1573: 578, 1604: 625. Penni 1515: 4. Petrasancta 1687: 36. Petri 1723, facing p. 120. Piso 1658 (see Bontius 1658), frontispiece. Pomet 1694: 24. Scheuchzer 1731, pl. 21. Schott 1662, pl. 47 facing p. 1084. van Sichem 1739: 10. Tachard 1687, facing p. 88. Tempesta 1650, fig. 85. Thevet 1557: 41; 1558: 41 (different from 1557), 1575: 403. Topsell 1607: 595. Valentini 1714, frontispiece (after Leguat). Valerianus 1631: 26.

3.10.4 Iconography of Dürer's rhinoceros

Review: Clarke 1973. Cole 1953. Coste 1946. Lach 1970: 162-168. Rieth 1974: 85-88.

Remarks: Armand 1879: 101 (emblem of Alessandro de Medici). Brentjes 1978: 150-152 (Dürer, Meissen porcelain 1732, Pompei rhino after Dürer). Buys 1978: 106 (Dürer, Gessner, Rubens, Barlow, cup Schloss Ambras). Camerarius 1595: 5 (emblem Alessandro de Medici). Chartrou 1928: 113 (entrée Henri II, Paris 1749). Clarke 1975a, 1975b: 35-37 (Meissen porcelain, 18th century), 1976: 4-7 (ceramics). da Costa 1937: 22-26 (Dürer). David 1913 (Pompei rhino after Dürer). Dembeck 1965 (Dürer). T. Dickinson 1929 (crest of weapon of Society of Apothecaries in England, 17th century). S. Dittich 1975. Dodgson 1903: 307, 1938: 51-55 (states of Dürer's woodcut). Einhorn 1976, fig. 27. von Erffa 1965: 93, fig. 27 (Pisa Dom, 1602; emblem of Alessandro de Medici). Ferro 1623, II: 49 (emblem of Alessandro de Medici). George 1969: 130, 148 (maps). Gowers 1950: 67 (Pompei rhino is classical), 1951 (Pompei rhino after Dürer), 1952: 288. Hébert 1969 (triumph Henri II, Paris 1749). Hediger 1938: 1872, 1949: 85, 1970. Heikamp 1980: 302-307. Honour 1975, nos. 81, 87 (symbol of America). Iversen 1961: 81, pl. 13 (Paris 1749). Jarry 1959 (gobelins 'Les Indes', 18th century). Jovius 1555: 50 (emblem of Alessandro de Medici). Keller 1909: 387 (head in Rome's Thermenmuseum from Forum Trajanum). Killermann 1908: 580, 1910: 85. Lang 1961b: 370, fig. 2 (Pisa Dom). Laufer 1914: 77-79 (Ferdinand Verbiest, 1659), 84 (Dürer), 85 n. 2 (Pompei rhino after Dürer). Marlier 1966: 351, fig. 293. de Matos 1960: 388. Mauro 1556:

246 (Pompei rhino is classical). Nais 1961: 92 (Dürer's woodcut in Bibliothèque Du Prat). Nestor 1564: 174, 193 (emblem of Alessandro de Medici). Palm 1956 (Tunja, Columbia). Pluis et al. 1974: 11, 12, 31, 107 (Dutch tiles; A. de Bruijn 1583). Reinach 1913 (Pompei rhino after Dürer). Roethlisberger 1967: 109, fig. 11 (Belgian tapestry, early 17th century). Rookmaaker 1973c: 41-44; 1976: 89 (Barlow 1684), 1978b: 20-22, 1981: 111. M. Ryhiner 1952: 68. Sainéan 1915: 218, 1921: 38, 1922: 22, 41, 1927: 36, 81 (Rabelais saw living rhino at Kleberger's in Lyons). Sainéan 1922: 22 (triumph Henri II, 1549). Salomon 1943 (Rabelais saw Dürer's woodcut at Hans Kleberger in Lyons). Sperlich 1961 (Italian sculptures). Spinazzola 1913a, b (Pompei rhino after Dürer). Swaen 1940: 37 (Leguat's illustration after Tachard). Taylor 1955: 55 (Barlow). Toynebee 1973: 126 (Pompei rhino is classical).

3.10.5 Other plates of 1515 rhinoceros

Clarke 1974: 113 (Burgkmair). Dodgson 1938: 55 (Burgkmair). Ehlers 1917: 168 (Aldorfer, Gebetbuch). Killermann 1910: 85 (Aldorfer). Lach 1970: 162, 170. Rieth 1974: 86 (Aldorfer, Burgkmair). Rookmaaker 1973c: 44, fig. 2 (Burgkmair).

3.11 THE SECOND LISBON RHINOCEROS 1579

3.11.1 History - sources

le Blanc 1654: 137 (Madrid, eyes put out). de Caverel 1859: 301, 303 (Lisbon, 1582). de Cobarruvias 1611: 112r. van Linschoten 1644: 70 (Madrid, 1581). de Mendoza (1584) in Staunton 1854: 312 (Madrid). du Molinet 1692: 193. de Sande 1590: 208 (Madrid). Sassetti 1855: 133 (letter Lisbon, 15 Feb. 1579).

3.11.2 Illustrations published before 1800

Camerarius 1595, pls. 4, 5. Ferro 1623, II: 49 (after Camerarius).

3.11.3 History and iconography

Camerarius 1595: 6, 7 (engravings after Galle). de Castilho 1956: 173. Clarke 1974: 113, 1975a, 1975b: 36 (Galle 1596, Collaert 1612), 1976: 7. Heikamp 1980: 307. Jahn 1970 (drawing Lazarus Roeting, Lisbon). Lach 1970: 169. Llopis 1974a: 28 (Madrid). du Molinet 1692: 193 (Galle). Pinto et al. 1942: 146 (Madrid 1584). Pluis et al. 1974: 21, 70 (Collaert 1612, on Dutch tiles). Rookmaaker 1973c: 44, 1978b: 22 (drawings after Galle), 1980a: 67.

3.12 THE FIRST LONDON RHINOCEROS 1684

3.12.1 History - sources

Evelyn (1684) 1955: 389-390 (London, October 1684). Pomet 1694: 26 (seen by friends in London). Ray 1693: 123 (England 1684-85). Scheuchzer 1721: 389 (England 1684-85).

3.12.2 History and iconography

Altick 1978: 37 (London August 1684 - September 1686). Beckmannus 1766: 39. Camper 1782: 138. Clarke 1974: 114, 1975a, 1976: 9. Duke 1739: 4. Fitzinger 1836. Gowers 1952: 288. Houttuyn 1761: 331. Klein 1751: 28, 1760: 32. Newdigate-Newdegate 1901: 245 (summer 1684, sold to Langley £2320). Oken 1838: 1193. North 1826: 168-169 (visit by Dudley North). Parsons 1743: 523. Pasteur 1793: 141.

Reinhard 1748: 6. Rookmaaker 1973c: 45, 1978b: 23, 1980a: 68. M. Ryhiner 1952: 69.

3.13 THE SECOND LONDON RHINOCEROS 1739

3.13.1 *History - sources*

Beckmannus 1766: 39. Buffon & Daubenton 1764: 179 (after Parsons). Camper 1782: 138. Dryander 1796: 65 (illustrations). Duke 1739: 4, 11. Klein 1751: 28, 1760: 32. Meijer 1750, pls. 29, 30 (after Parsons). Otto 1788: 176, 199 (Meijer's figures after Parsons). Parsons 1743: 523, 527 (London, from 24 June 1739). Pasteur 1793: 141.

3.13.2 *Illustrations published before 1800*

Duke 1739, pl. 1. Parsons 1743, pls. 1, 2; 1747, pls. 1, 2; 1760, pls. 1, 2. Shaw 1746: i (after Parsons). Meijer 1750, pls. 29, 30 (after Parsons).

3.13.3 *History and iconography*

Chenu & Desmarest 1858: 3. Clarke 1974: 115. Duncan 1892: 323. Dryander 1796: 65. Fitzinger 1836, 1860: 50. Gowers 1952. Loisel 1912, II: 17. Oken 1838: 1194. Rookmaaker 1973c: 46, 1978b: 19, 23-30, 1980a: 78.

3.14 THE DUTCH RHINOCEROS 1741-1758

3.14.1 *History - sources*

Anon. 1751, 1780: 266. Albinus 1747, pls. 4, 8 (Leiden 1742). d'Argenson 1863: 485 (Lyons 1749), 1864: 77 (shipwreck near Rome, 1749). Barth 1747 (Regensburg 1747). Beckmannus 1766: 39. von Bergen 1746 (Frankfurt/Oder 1746). van Berkhey 1784: 48 (Holland, 1758). Bonannius 1773: 16 (Rome, 1750). Buffon & Daubenton 1764: 179, 190, 198-203, pl. 7 (Paris and Italy 1749). Camper 1782: 139, 147, 176 (Holland 1748). 1767: 6-7 (critique of plate by Albinus). Coyer 1769: 181 (Paris 1749, fashion 'en rhinocéros'). Dryander 1796: 65 (illustrations). Edwards 1758: 24, fig. 221 (London 1752). Freytag 1747: 3 (Leipzig 1747). Guiard de Servigné 1750 (Paris 1749). Houttuyn 1761: 331, 334. Klein 1751: 28, 1760: 32 (Danzig, 1754). Ladvoat 1749: 3, 7, 10 (Stuttgart 1748, Paris 1749). Mentzel (1785) 1921: 27 (Berlin, Breslau 1746-47). Parsons 1743; 1747: 3 (introduction by editor, not yet seen in Neuremberg), 1760: 254 (Paris 1749). Pasteur 1793: 141. Ridinger 1768, pl. 53 (Augsburg 1748).

3.14.2 *Illustrations published before 1800*

Albinus 1747, pls. 4, 8. Bonannius 1773 (in Rome?). Brink 1778, pl. facing p. 36 (after Buffon). Buffon & Daubenton 1764, pl. 7 (Paris 1749). Edwards 1758, fig. 221. Freytag 1747, frontispiece. Ladvoat 1749, pl. 1. Parsons 1760, pl. 1*. Ridinger 1768, pl. 53. Shaw 1800, pl. 60 (after Edwards). Tasso 1784, facing p. 139 (after Buffon, reproduced in Rookmaaker 1982: 10).

3.14.3 *History and iconography*

Review: Clarke 1974: 116-120, 1975a, 1976: 9-15. Emmerig 1978 (medals and engravings, itinerary). Faust 1976. Rookmaaker 1973c: 46-56.

Records: Barbier 1857, IV: 356 (Paris 1749). Barrington 1803: 253. Beyerinek &

de Boer 1935: 91 (Amsterdam 1741). Brod 1958 (Würzburg 1748, Vienna 1751). Chenu & Desmarest 1858: 3, 8 (London 1741, Paris 1749, drowned Italy). Clarke 1975b: 37 (Dresden 1747, London 1751). Coste 1946: 125-127. Cuvier 1806: 28 (Paris 1749). Dash 1861: 2 (Paris 1750, fashion 'à la rhinocéros'). Dembeck 1965: 285 (Ridinger). Doran 1876: 302 (Florence 1750). Dryander 1796: 65 (drawings). Duncan 1892: 323 (Paris 1749). Fiocco 1929: 77, pls. 86, 87A (Venice 1751). Fitzinger 1836 (Paris 1749, Vienna 1750), 1860: 50 (1746-1752). Gee 1952b (coin 1748). Gleiss 1967: 42 (Breslau 1746). Giese 1962: 49 (Vienna 1750). Goldsmith 1816: 360 (London, 18 years old). Gowers 1952: 289. Hediger 1938: 1872 (Leipzig 1747), 1949: 86, 1970: 101 (Stuttgart 1748), 1977: 9 (Zürich 1748). Heikamp 1980: 309-319. Houtzager 1979: 59. Hufnagel 1873 (Frankfurt/Oder 1747). Killermann 1908: 582 (Regensburg 1746). Kounist 1976: 37 (Ridinger). Kramer 1756: 317 (Vienna 1750). Kroker 1890: 126 (Leipzig 1747). Krumbiegel 1962 (Venice 1751 possibly *R. sondaicus*, Stuttgart 1747). Laufer 1914: 85 note 2. Lehmann 1952: 64-66. Levey 1956: 72-74 (Venice 1751). Loisel 1912, II: 11, 50, 278. Molmenti 1885: 383 (Venice 1751). Muller 1876, no. 3786 (poster 1747). Oken 1838: 1194. Petzsch 1930: 140 (Stuttgart, coin 1748), 1935 (history 1747-48), 1954 (Dresden, Leipzig 1747), 1961. Punt 1977: 340 (Holland 1741, rhino in Albinus a symbol of *vis vitalis*). Reinhardt 1912: 751. Rieth 1974: 88, fig. 13 (Regensburg 1748). Rookmaaker 1978a (Amsterdam 1741, 1748), 1978b: 30 (London 1751), 1980a: 68, 1982: 9. Sainéan 1921: 39 (Versailles 1749). Sewter 1949: 28, pl. 11 (bronze rhinos). Sliggers 1982: 147, fig. 95 (Haarlem 1756). Stricker 1881 (coin Neuremberg 1748). Thieme & Seifert 1978: 12-13, pl. facing p. 68 (Leipzig 1747). Thienemann 1856: 61, 212 (Augsburg 1748). Tourneux 1877, I: 272 (Paris 1749). Ullrich & Ullrich 1968: 190, 193, 258, 259 (Leipzig 1747). Weihrauch 1967: 443 (bronze statue in Louvre). Witkamp 1869, II: 110 (Amsterdam 1741).

3.15 THE RHINOCEROS OF VERSAILLES 1770-1793

3.15.1 *History - sources*

Buffon 1778 (arr. 1770). Camper 1782: 127, 160, 175 (seen 1777). Faujas-St. Fond 1809: 203, 205, pl. 9 fig. 1, pl. 10 fig. 1. Pallas 1780: 211 (Camper's visit). Pasteur 1793: 141. Sander 1779.

3.15.2 *History - remarks*

Cave 1976b: 414 (dissection). Chenu & Desmarest 1858: 3. Clarke 1974: 121, 1976: 15, fig. 54. Cuvier 1804a,b, 1812a, 1st pl. (description skeleton), 1836b, pl. 39 (skeleton). Duncan 1892: 323. Desmarest 1819: 240. Gervais & Gervais 1875a: 414 (drawings of dissection). Groves 1971: 241 (horn). Hamy 1893: 9 (alive 1789). Jouin 1889: 226ff, 263ff (drawings of dissection). Lacroix 1977: 13-19 (early history, 1770-1771). Loisel 1912, II: 143 ('rhinocéros bicorne', arr. 1770). Neuville 1927: 196, fig. 3 (keratinisation). Rookmaaker 1973c: 57, 1980a: 68.

3.16 PIDCOCK'S MENAGERIE, LONDON

Altick 1978: 39 (painting Stubbs). Clarke 1974: 121, 1975a, 1976: 15. Cuvier 1806: 28, 1812b. Duncan 1892: 323 (arr. 1790, present to Mr. Dundas, purchased £ 700). Grigson 1955: 173, pl. 34 (drawings Stubbs, ca. 1772). Jardine 1836: 171 (London 1790-93, 1799). Lenz 1835: 327 (London 1770). Loisel 1912, II: 17 (arr. 1770, 1799). Rookmaaker 1973c: 57 (arr. 1770, 1790, 1799), 1980a: 69 (arr. 1790, 1799). Taylor

1955: 63 (painting Stubbs 1772), 1971: 210 (drawings and painting Stubbs, ca. 1772).

3.17 MISCELLANEOUS ANIMALS IN CAPTIVITY

3.17.1 *On board the Shaftesbury 1737*

Buffon & Daubenton 1764: 175 (after Edwards). Edwards 1758: 25 (sketch seen, caption reproduced). Rookmaaker 1973c: 45. M. Ryhiner 1952: 69.

Note: The original sketch of 1737, mentioned by Edwards, is in the British Museum, London, Print Room: Sloane collection 5261 (Drawings of Quadrupeds), no. 44.

3.17.2 *Other animals*

Chardin 1711: 45 (one animal in Ispahan - cf. Coste 1946: 123, Loisel 1912, II: 6). Dannenfeldt 1968: 143 (Aleppo 1575, seen by Rauwolff). van Goens (1656) 1856: 313 (menagerie on Java). Pasteur 1793: 141 (double-horned animal drowned near Mannheim). Rauwolf (1582) 1971: 267 (Aleppo, Persia). Tavernier (1676) 1977, I: 93 (tame in Jahanabad, India). Thevenot 1727: 133 (Dehly). Turpin (1771) 1811: 619 (Siam, donation to king). Varthema (1510) 1928: 22 (Mecca, 2 one-horned animals, donated by a king of Ethiopia).

3.18 ICONOGRAPHY OF THE AFRICAN RHINOCEROS

3.18.1 *Plates of African rhinoceros published before 1800*

Allamand 1781, pl. 5, 1782, pl. 6, 1785, pl. 1 (by R.J. Gordon). Bruce 1790, facing p. 85 (after Buffon, with second horn). Buffon 1778, pl. 57 (double horn). Camper 1780, pls. 5-8, 1782, pls. 1-3 (head and skull). Daniell 1805, pl. 30. de Flacourt 1661, facing p. 66. Kerr 1792, pl. 162 facing p. 133 (after Sparrman). Klein 1751, pl. 2 (double horn). Kolb 1727, facing p. 190 (by Jan Wandelaar). Merck 1784, pl. 2 figs. 1-3 (skull parts), 1786, pls. 1, 2 (upper and lower jaw). Parsons 1766, pl. 2 (double horn). Shaw 1800, pl. 61 (after Allamand). Sparrman 1778, pl. 9 (side-view of body and skull), 1779 (penis), (1787) 1977, II pl. 3 (as 1778).

3.18.2 *Remarks on African rhinoceros*

Anon. 1872: 318 (on Kolb). de Bouveignes 1953 (quotes Sparrman). Cave & Rookmaaker 1977: 139-149 (drawings and notes of R.J. Gordon at the Cape 1777-80), 154-155 (Sparrman's dissection). Forbes 1977: 36 (Kolb, Sparrman, Allamand). Forbes & Rourke 1980: 19, 55, 173 (Paterson's collection, Cape, ca. 1778). Hallema 1951, pls. 22, 22a (drawings by Johannes Schumacher, Cape, 1776-77). Killermann 1908: 582, fig. 581, 1910: 86 (double-horned rhino on ostrich egg, late 17th century). Meester 1973: 7 (drawing by F. Levaillant, Cape, 1781-84). Nicol 1982: 42-43 (Paterson's collection, ca. 1778). Rieth 1974: 88 (Ridinger drew double-horned rhino). Rookmaaker 1976a (early reports; plate by Wandelaar in Kolb 1727), 1982 (take double-horned animals.) Zukowsky 1965: 8-27 (early reports).

3.19 MISCELLANEOUS ILLUSTRATIONS BEFORE 1800

Ancieu 1552: 17. Augustin 1587, pl. 63 (Domitian coin). von der Behr 1689, frontispiece (one-horned rhino). Bell 1793, pls. 2-4 (Sumatran rhino). Blumenbach 1791, pl. 45 (Mannheim rhino), 1796, pl. 7 (skulls of African and Asiatic rhinos).



FIGURE 1
A double-horned (Sumatran?) rhinoceros found in an early collection of drawings with material belonging to Andreas Cleyer in 1680 (*Miscellanea Cleyeri, Libri Picturati A. 38* - Jagellon library, Cracow).

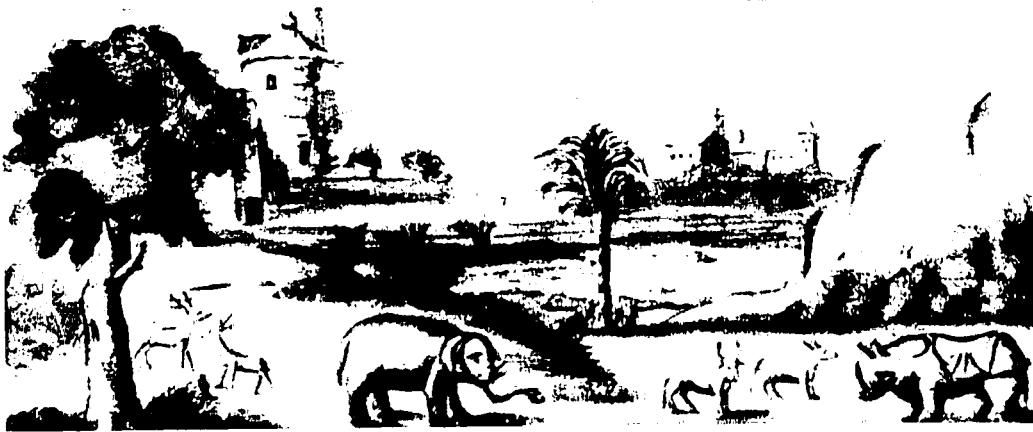


FIGURE 2
P. Bonannius, *Rerum naturalium ... in Museo Kircheriana*, vol. 1 (1773): the rhinoceros may have been inspired by the animal seen in Rome in 1750.



FIGURE 3
Painting by James Parsons (1705-1770) of the Indian rhinoceros in London in 1739 (British Museum (Natural History), Mammal section, London).



FIGURE 4
Bronze rhinoceros (15 x 27 cm) made by François Pompon in 1933 (Musée de Dijon).

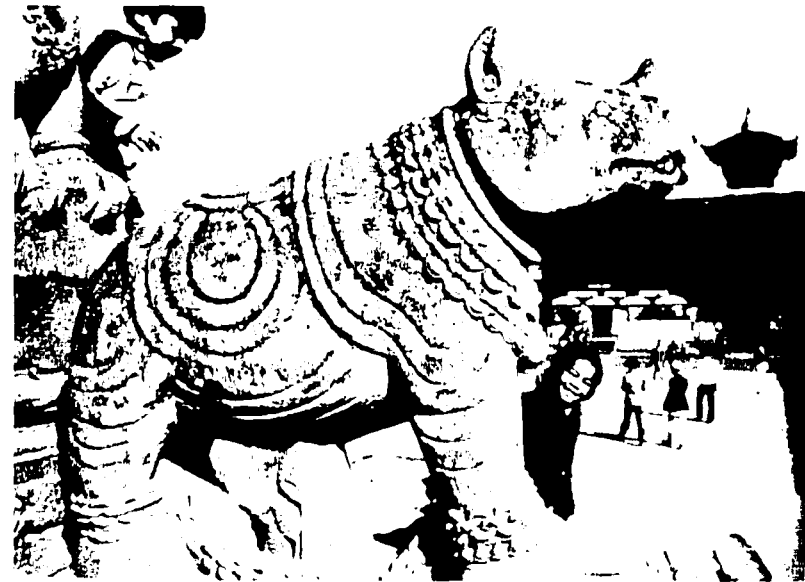


FIGURE 5
Rhinoceros with chains on the staircase of the Batsala Devi temple in Bhaktapur near Kathmandu, Nepal.

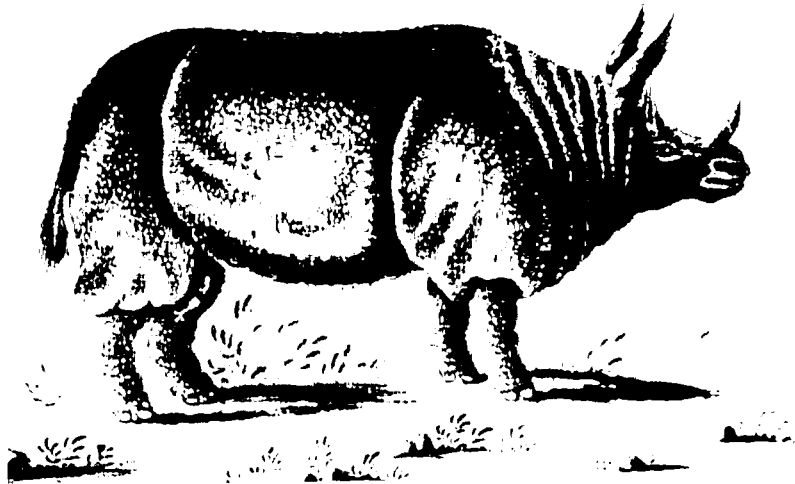


FIGURE 6
Sketch made on board the *Shafesbury* in 1737 (Sloane Manuscripts 5261 no. 14, reproduced by permission of the Trustees of the British Museum).



FIGURE 7
Sumatran rhinoceros "Subur" photographed in the Copenhagen zoo in September 1965 by Lothar Schlawe.

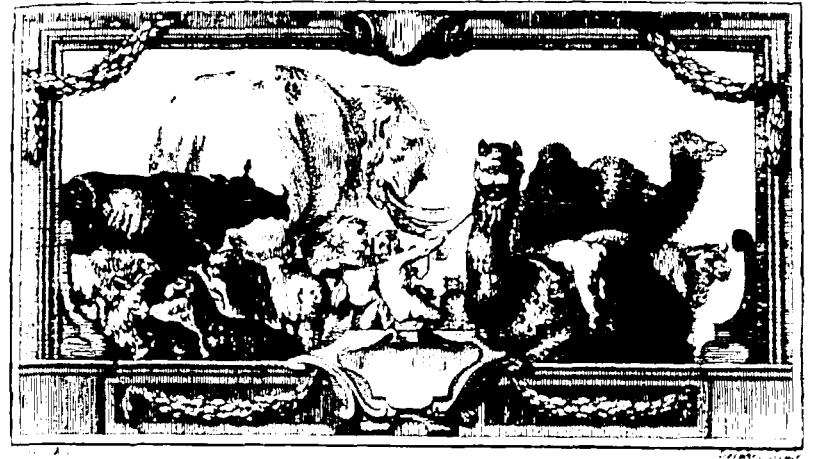


FIGURE 8
Vignette from Buffon's *Histoire Naturelle* with the Indian rhinoceros exhibited in Paris in 1749.

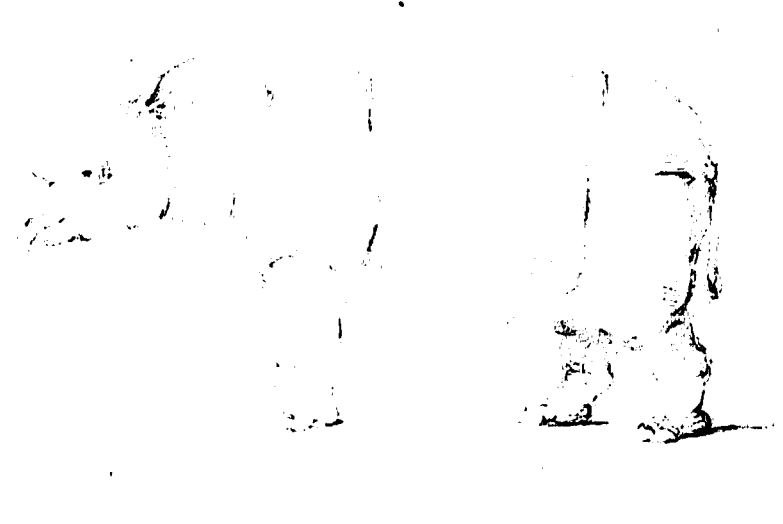


FIGURE 9
Drawing of a Javan rhinoceros in a collection made by Thomas Horsfield (1773-1859) in Java (India Office Library, London).

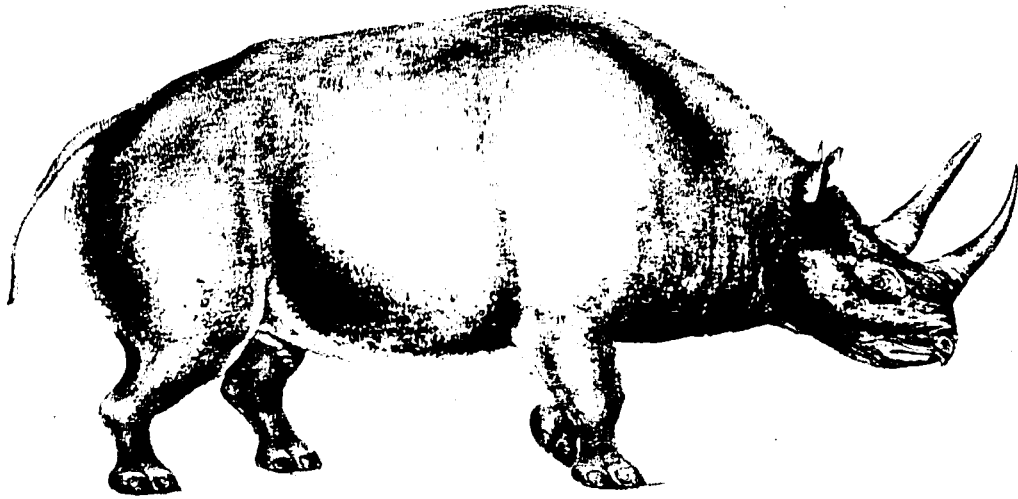


FIGURE 10
The *Rhinoceros keitloa* drawn by Gerald Ford, later published in Andrew Smith's *Illustrations of the Zoology of South Africa*, 1838 (R.T. Gunther collection no. 189, University of Witwatersrand, Johannesburg).



FIGURE 11
A page in the *Memoirs of Babur*, in a manuscript prepared about 1590 (British Library, Department of Oriental manuscripts, ms. OR 3714, folio 379a).



THE EXETER CHANGE MENAGERIE, AS IT WAS IN 1750

FIGURE 12
The Exeter Change menagerie in London in 1813 (The Museum of London).

after unpublished plate by P. Camper). Bonannius 1773, pl. 3 no. 54 (horn). Bontius 1658: 50 (head and skull). Buffon & Daubenton 1764, pl. 8 (horns). Camper 1782, pl. 3 fig. 4 (Domitian coin). Chardin 1711, pl. 40 (one-horned rhino). Pallas 1780, pl. 9 (parts of jaw of Javan rhinoceros, drawn by P. Camper). Parsons 1743, pl. 3 (horns, tail, feet, penis). Schoutens 1676, frontispiece (one-horned rhino). Sloane 1749, pl. 2 figs. 5, 7 (Domitian coin). Spanheim 1671: 138 (Domitian coin). Vogel 1716, frontispiece (fight of rhino and elephant).

ANALYSIS OF THE LITERATURE

PART 2

BIOLOGY

CHAPTER 4

THE FAMILY RHINOCEROTIDAE

4.1 GENERAL POPULAR WORKS

Brehm 1877. Buffon & Daubenton 1764. Chenu & Desmarest 1858. E. Desmarest 1819. Dubois 1852. Duncan 1892. Frädrieh & Frädrieh 1973. Gervais 1855. Giebel 1855. Grzimek 1969: 33-72 (with chapters by E. Thenius, E.M. Lang, B. Grzimek and H.G. Klös). Guggisberg 1966a. Hillenius 1971. van der Hoeven 1855. Jardine 1836. Kaup 1833. Llopis 1974a, b, c. Oken 1838. Simon 1966-1971. Stonehouse 1981. Vogt 1884. Walker 1964.

4.2 NAMES OF THE FAMILY GROUP

4.2.1 *Names*

Akynodontes Brandt 1878a: 25.
Atelodinae Osborn 1900: 262 (Atelodiens Pomel 1853: 112, tribe of family Perissodactyla).
Bicornes Brandt 1878a: 41 (type genus *Ceratorhinus*).
Ceratorhinae Osborn 1898: 121 (type genus *Ceratorhinus*).
Ceratotheriinae W.O. Dietrich 1945 (*Palaeontographica*, Stuttgart, 96A: 46-90), (type genus *Ceratotherium*).
Colobotemnodontes Brandt 1878a: 51 (cohors of Bicornes).
Dicertinae Ringström 1924: 97 (type genus *Diceros*).
Dicerorhinae Ringström 1924: 5 (type genus *Dicerorhinus*).
Dicerorhininae Simpson 1945: 142 (type genus *Dicerorhinus*).
Dicerorhinini Loose 1975: 7 (type genus *Dicerorhinus*).
Dicerotes Friant 1950: 337.
Dicerotinae Ellerman et al. 1953: 162, Deraniyagala 1953: 13 (type genus *Diceros*).
Dicerotini Loose 1975: 7 (type genus *Diceros*).
Nasicornia Illiger 1811: 97.
Rhinocerotidae Blyth 1875: 50. also Lapsus for Rhinocerotidae in the synonymy of Gray 1868: 1005.
Rhinocerotina Gray 1868: 1005, attributed to Bonaparte 1839 hence lapsus (or Rhinocerotina).
Rhinoceria Rafinesque 1815: 56 (subfamily of Bellua, type genus *Rhinoceros*).
Rhinocerida Haeckel 1895: 545 (type genus *Rhinoceros*).
Rhinoceridae Chenu & Desmarest 1858. (*Rhinocérides* Billberg 1828).
Rhinocerina Gray 1825: 343 (tribe of Elephantidae, type genus *Rhinoceros*).
Rhinocerinae Zittel 1891: 288 (type genus *Rhinoceros*).
Rhinoceroscidae Brookes 1828: 74 (type genus *Rhinoceros*).
Rhinocerotina Bonaparte 1838a: 112, 1838b: 253 (subfamily of Elephantidae, type genus *Rhinoceros*).
Rhinocerosidae Lesson 1842: 158 (type genus *Rhinoceros*).

Rhinocerotus Gray 1873a: 356 (type genus *Rhinoceros*).
 Rhinocerotidae Owen 1845: 587. Schinz 1845: 332 (type genus *Rhinoceros*).
 Rhinocerotinae Dollo 1885: 295 (type genus *Rhinoceros*).
 Rhinocerotina Frisch 1775: 4 (book not accepted for nomenclature).
 Rhinocerotinae Brandt 1878a: 25 (type genus *Rhinoceros*).
 Rhinocerotini Dollo 1885: 295 (type genus *Rhinoceros*).
 Rhinocerotoidae Gill 1872: 84 (superfamily).
 Rhinocerotidae Gray 1821: 306.
 Rhinocerotini Zammarano 1930: 165.
 Unicornes Brandt 1878a: 33 (type genus *Rhinoceros*).

4.2.2 Remarks

Blumenbach 1796, pl. 7 (R. unicornis and R. bicornis belong to two different orders, Bruta and Glires, following dentition). Groves 1971 (shape and size of horns as taxonomic character; usually at most identify genus), 1975: 200 (rejects Ceratotheriinae).

4.2.3 Lists of synonyms

Chenu & Desmarest 1858. Grassé 1955: 1119-1125. Gray 1868: 1005. Heissig 1973. Simpson 1945: 140-143.

4.3 NAMES IN THE GENUS GROUP

4.3.1 Names

Atelodus Pomel 1853: 114 (subgenus of *Rhinoceros* with 4 fossil and 3 recent species).
Ceratohinus Gray 1868: 1006 (type species *C. sumatrensis*).
Ceratotherium Gray 1868: 1006, 1027 (type species *C. simum*).
Coelodonta Bronn 1831 (type species *C. antiquitatis*).
Colobognathus Brandt 1878a: 51 (subgenus of *Atelodus* including *A. bicornis* and *A. simus*).
Cyclochilus Brandt 1878a: 55 (section B of subgenus *Colobognathus* including *A. simus*).
Dactylochilus Brandt 1878a: 52 (section A of subgenus *Colobognathus* including *A. bicornis*).
Dicerorhinus Gloger 1841: 125 (type species *D. sumatrensis*). See 4.3.2
Diceros Gray 1821: 306 (type species *D. bicornis*).
Didermocerus Brookes 1828: 75 (type species *D. sumatrensis*). See 4.3.2
Eurhinoceros Gray 1868: 1009 (subgenus of *Rhinoceros*)
Keitloa Allen 1939: 556 (in list of synonyms, attributed to Gray 1868: 1025 with type species *R. Keitloa*, but the name appears there as species and as variety not as genus or subgenus name).
Monoceros Rafinesque 1815: 56.
Opsiceros Gloger 1841: 125 (type species *O. africanus* = *bicornis*).
Rhinaster Gray 1862: 282, 1868: 1006, 1023 (referring to 'Gray, List Mamm. B.M. 1840; Gerrard, Cat. Bones B.M. 281' (not seen); type species *R. bicornis*). Allen 1939: 556 (preoccupied by *Rhinaster* Wagler, 1830, Mammalia: Insectivora).
Rhinoceros Linnaeus 1758: 56 (type species *R. unicornis* - see Elliot 1907: 104. Pocock 1914, Rookmaaker 1980b: 258).
Unicornus Rafinesque 1815: 219 (replacement for *Monoceros*).

4.3.2 Validity of *Didermocerus* and *Dicerorhinus*

Boylan 1967a (proposes suppression of *Didermocerus* because *Dicerorhinus* is generally used; the two names are objective synonyms with the same type species), 1967b: 119 (*Didermocerus* predates *Dicerorhinus*, the latter usually used by paleontologists). Boylan & Green 1974 (list of use of the two names in literature; reformulates suggestion to suppress *Didermocerus*). Ellerman & Morrison-Scott 1951: 339 (*Didermocerus* is valid). Groves 1967c (use of *Didermocerus* leads to difficulties; argues for suppression of Brookes's catalogue for nomenclature). Hooijer 1967 (*Dicerorhinus* consistently used by paleontologists; argues for suppression of Brookes's catalogue for nomenclature). Loose 1975: 15 (urges use of *Dicerorhinus*). Medway 1977: 144 (*Didermocerus*, will probably become *Dicerorhinus*). Melville 1977 (*Didermocerus* is suppressed, *Dicerorhinus* and *sumatrensis* placed on official list of zoological names; Brookes 1828 is approved as available for zoological nomenclature). Pocock 1945b: 450 (*Didermocerus* instead of *Dicerorhinus*). Simpson 1945: 142 (prefers *Dicerorhinus*; Brookes 1828 is not a publication and *Didermocerus* not used). van Strien 1974a: 6 (review), 1977a (reports on Melville 1977). Thomas 1901 (*Dicerorhinus* antedates *Ceratohinus*).

4.3.3 Lapsus in genus names

<i>Biceros</i> , Virchow 1910	<i>Diceros</i> , Billberg 1827
<i>Ceratohinus</i> , Jentink 1889	<i>Didarmocerus</i> , Jenyns 1955
<i>Ceratotherium</i> , Hayes 1964	<i>Didermoceros</i> , Metcalfe 1961, Maliepaard & de Vos 1961.
<i>Cerathoterium</i> , Malbrant 1936: 25	<i>Didermocerus</i> , Schlawe 1961
<i>Ceratotherium</i> , Blancou 1935a	<i>Rhinoceros</i> , Billberg 1827
<i>Dicera</i> Berger, 1910b	<i>Rhinoceros</i> , Le Viet Du 1969.

4.3.4 Remarks

Ellerman 1954: 79 (type species of *Diceros*). Owen-Smith 1973: 13 (validity of *Ceratotherium*). Thomas 1901: 158 (*R. simus*, if not belonging to *Diceros* with *D. bicornis* should be placed in *Coelodonta* Bronn).

4.4 CLASSIFICATION

4.4.1 Review

Guérin 1980: 28.

4.4.2 All recent species in one (sub-) family

Abel 1919. Dollo 1885: 295. Heissig 1973 (all recent species in tribus Rhinocerotini of Rhinocerotinae). Matthew 1931: 9. Steinmann & Döderlein 1890: 774. Weber 1904: 626. Woodward 1898.

4.4.3 Division in *Rhinocerotinae* (*Rhinoceros*) and *Dicerorhininae* (*Dicerorhinus*, *Diceros*, *Ceratotherium*)

Friant 1950: 337 (in divisions Rhinocerotus and Dicerotes). Heymans & Colyn 1981. Grassé 1955: 1119-1125. Loose 1975: 7-8 [*Dicerorhininae* with 2 tribes: *Dicerorhinini* (*Dicerorhinus*) and *Dicerotini* (*Diceros*, *Ceratotherium*)]. Schauric 1968: 288. Simpson 1945: 141-143, 257. Viret 1958: 446.

4.4.4 *Division in Rhinocerotinae (Rhinoceros, Dicerorhinus) and Dicerotinae (Diceros, Ceratotherium)*

Deraniyagala 1953. Ellerman et al. 1953: 162. Gervais 1855: 162-165. Gray 1868, 1869b. Groves 1967a: 221, 1975: 200. van der Hoeven 1855: 919. Pocock 1945b: 449-450. Selater 1872c: 426, 1873a: 140.

4.4.5 *Division in Rhinocerotinae (Rhinoceros), Dicerorhininae (Dicerorhinus) and Dicerotinae (Diceros, Ceratotherium)*

Brandt 1878a, b, c, 1879 [recent species in Rhinocerotidae, legio II: Akynodontes, Subfam. IV: Rhinocerotinae, with cohorts A: Holodemnodontes group b: Unicornes (*Rhinoceros*) and group c: Bicornes (*Ceratorhinus*); and with cohorts B: Colobotemnodontes (*Atelodus*)]. Breuning 1924. Flower 1876, 1891. Guérin 1980: 28. Thenius 1969: 545, 548, 1972: 272. Zeuner 1934: 28.

4.5 PHYLOGENY AND EVOLUTION

Baker 1967: 383. Colbert 1942. Colbert & Hooijer 1953: 102. Cope 1881: 394. Dollo 1885: 299. Groves 1972: 2. Guérin 1979 (postcranial skeleton of African species), 1980: 1055-1058. Guggisberg 1966a: 23-32. Haeckel 1895: 545. Heissig 1973: 28. Heller 1913: 16-18. Hooijer 1969, 1973, 1976. Hooijer & Patterson 1972: 25. Kingdon 1979: 82-86. Klaitz 1972 (mesaxonic symmetry). Lang 1923: 157. Laurie 1978b: 345-369, 390-393 (evolution of behaviour). Laurie & Olivier 1977: 658. Lydekker 1881: 56. Matthew 1931, 1932: 438-440. Nicholson & Lydekker 1889: 1363-1371. Osborn 1898: 98-103. Owen-Smith 1973: 6-12. Stehlin 1930 (evolution of dentition). Thenius 1969: 543ff, 1972: 272-274. E. Thenius in Grzimek 1969: 33-37. Thenius & Hofer 1960: 197-202. Viret 1958: 447. Zeuner 1934: 36-44 (evolution of skull).

4.6 MORPHOLOGY

4.6.1 *Differences between Diceros and Ceratotherium*

Berger 1910b: 345. Bryden 1893: 490, 1897: 185. Cave 1962b: 698. Cooke 1950: 405. Coryndon 1894: 311. Deraniyagala 1953. Groves 1972: 1, 1975: 200. Heller 1913: 13. Hooijer & Singer 1960. Jardine 1836: 186. Kirby 1920: 226, 235. Lang 1920: 72. Malbrant 1936: 25. Maydon 1932: 119. Owen-Smith 1973: 11. Peel 1900: 298. Player & Feely 1960: 6. Renshaw 1904: 129. Roosevelt & Heller 1915, II: 638-640. Schmidt-Schaumburg 1953. Schouteden 1911: 120, 1927: 26, 1945: 263. Selater 1890: 521. Sidney 1965: 51.

4.6.2 *Differences between Dicerorhinus and Rhinoceros*

Van Balen 1914: 218. Beddard 1902: 254. Blyth 1862a: 154-159, 1872b: 3104. Chakraborty 1972. Colbert 1942. Colbert & Hooijer 1953. Delsman 1951, fig. 41. Flower 1878. Gray 1868: 1006-1009. Grzimek 1960a: 23. Guggisberg 1966a: 133. Hooijer 1945: 252, 1946a: 9-12. Koningsberger 1902: 60. Pocock 1945b. Selater 1874. Shebbeare & Roy 1948: 89. Sody 1959: 113-116. Weatherbe 1939: 155.

4.6.3 *Structure of horn*

Anthony 1928: 184. Boas 1931: 551. E. Desmarest 1819: 238. Dove 1935: 387. Earland et al. 1962: 1289, 1291. Grassé 1955: 1109-1110. Hayman 1956: 4. Hitzheimer 1935: 1502. Kneeland 1854. Lynch et al. 1973. Makinson 1954. Neuville 1927: 184-187. Ryder 1962a, b. Schaurte 1968: 289. Wood 1851: 753.

4.7 EXHIBITS IN CAPTIVITY

Management reviews: Blaszkewitz 1980. Crandall 1968. Jones 1979. Lang 1976. Nelson 1978. Silberman & Fulton 1979.

Exhibits in zoos: Bürger 1976 (Magdeburg). Crandall 1968: 509. Gaebler 1883a: 209 (Berlin). Klös 1961b: 47 (Berlin). Lang 1961a (Basel). Mottershead 1961 (Chester). Schmidt 1967 (Zürich). Toovey 1979 (London). Turck 1961 (Prague). Turner 1961 (Dallas).

CHAPTER 5

THE WHITE RHINOCEROS, CERATOTHERIUM
SIMUM

5.1 REVIEW

Backhaus 1964. Groves 1972. Heller 1913. H. Lang 1920. Owen-Smith 1973, 1975. Sidney 1965.

5.2 TAXONOMY AND NOMENCLATURE

5.2.1 *Revisions*

Brandt 1878a: 55-56 [Atelodus simus with 2 varieties: *Camptoceros* (nasal horn bent backwards) and *Prostheceros* (nasal horn bent forwards)]. Groves 1972: 1, 1975 (C. simum simum and C. simum cottoni).

5.2.2 *Remarks*

Brooks 1876: 110 (distinguished 'white rhinoceros' and 'rare long-horned white rhinoceros'). Guérin 1980: 171-172 (differences between subspecies).

5.2.3 *Subspecies and synonyms of Ceratotherium simum*

Rhinoceros burchellii Lesson, 1827: 332.

Type-specimen: not designated

Type-locality: interior of Cape (Lesson 1827)

Remarks: Lydekker 1916: 55 (name attributed to Desmarest 1822).

Taxon considered valid:

Rhinoceros burchellii Lesson 1827. - Boitard 1842.

Rhinoceros simus Burchelli; Potter 1947.

Rhinoceros camus Griffith, 1827: 290.

Type-specimen: not designated

Type-locality: Southern Africa (Griffith 1827)

Date: Description of rhinoceros appeared in Mammals, part 3 of Griffith, which may have been published in 1826; cf. C.F. Cowan, 'Notes of Griffith's Animal Kingdom of Cuvier (1824-1835)', *Journal of the Society for the bibliography of natural history*, 5(2): 137-140 (1969).

Taxon considered valid:

Rhinoceros camus Griffith 1827. - Falconer 1868.

Rhinoceros simus cottoni Lydekker, 1908: 319.

Type-specimen: skull and horns in British Museum (Natural History), donated by P.H.G. Powell-Cotton.

Type-locality: Lado dt., Sudan (Lydekker 1908).

Remarks: Groves 1975: 206-208 (differences from C.s. simum). Guérin 1980: 171-172 (differences from C.s. simum). Heller 1913: 29-36 (discovery, differences from C.s. simum). Hooijer 1969: 72-73 (differential characters of C.s. simum and C.s. cottoni small 'hardly worthy of subspecific distinction, yet... being universally upheld'). Jeannin 1951: 120 (no evidence for distinction from simum). H. Lang 1920: 72. Lavauden 1932: 508 (discovery). Owen-Smith 1973: 13. Roosevelt & Heller 1915, 11: 662. Schomber 1959 (discovery).

Taxon considered valid:

Ceratotherium cottoni; Hollister 1924.

Ceratotherium simum cottoni; Heller 1913. -(Note: This combination was generally used after 1960, except cf. *Diceros simus cottoni*.) - Allen 1939. Appelman 1958. van den Bergh 1955. Bere 1958. Dekeyser 1955. Haezaert 1959. Harper 1945. Lang 1924b. Mackenzie 1954. Micha 1958. Roosevelt & Heller 1915. Schouteden 1943, 1945. Schomber 1959. Setzer 1956. Verschuren 1958.

Ceratotherium simum cottoni; Blancou 1935a.

Diceros simus cottoni; Backhaus 1964. - Crandall 1968.

Rhinoceros simus cottoni Lydekker 1908. - Brocklehurst 1931. Fitzsimons 1920. Gyldenstolpe 1928. Trouessart 1909. Vialli 1955.

Rhinoceros (*Ceratotherium*) *simus cottoni*; Berger 1910b. - Bequaert 1916.

Rhinoceros (*Diceros*) *simus cottoni*; Lydekker 1916.

Rhinoceros kiaboaba Murray, 1866: 338.

Note: Murray mentioned in a list of species: '[R.] *Kiaboaba* Livingst. Central Africa,' without further description. Livingstone (1857: 71) found near Lake Ngami the 'kuabaōba, or straight-horned rhinoceros (R. Oswellii), which is a variety of the white rhinoceros.'

Taxon considered valid by Murray 1866 only.

Rhinoceros oswellii Elliot, 1847 in Oswell & Vardon 1847: 183.

Type-specimen: not designated. Gray (1853) described a pair of horns as *R. oswellii*, British Museum (Natural History), no. 1853.4.18.1 (figured Groves 1971, fig. 20).

Type-locality: the banks of the Makólwe river, tributary of the Limpopo (Oswell & Vardon 1847), Northern Transvaal.

Authorship: The name is generally attributed to Gray 1853. The animal was encountered by William C. Oswell during his second expedition of 1845-46 with Frank Vardon, and described in their report on the journey in the *Madras Journal of Literature and Science* (1847). The editor of the journal (W. Elliot according to Sherborn 1927, s.v. *oswellii*) added that he considered 'the existence of the Quebaba as a distinct species highly probable, we have named it provisionally after the discoverer *Rhinoceros Oswellii*'. The name also appears in the next issue (Oswell 1847).

Remarks: Brandt 1878a: 56-57 (synonym of A. simus). Brehm 1877: 519 (synonym of R. simus). Duncan 1892: 324 (variety of R. simus). Flower 1876: 456 (synonym of R. simus). Gray 1868: 1029 (new information). Murray 1866: 338 (synonym of R. simus). Oswell 1900: 141 (first supposed different species, but W.C. Oswell 'reverted... latterly to his original view'). Wood 1851: 760.

Taxon considered valid:

Ceratotherium oswellii; Gray 1868, 1869b.

Rhinaster oswellii; Gray 1862.
Rhinoceros oswellii Elliot in Oswell & Vardon 1847. - Drummond 1875.
Gray 1853. Oswell 1847.

Rhinoceros simus Burchell, 1817.

Type-specimen: holotype not designated. Cave 1962b: 694 (Lectotype: Oxford University museum, no. 8221, O.C. 1568, from W. Burchell; seven other syntypes in same collection).

Type-locality: Interior of South Africa (Burchell 1817). Cave 1947: 142 (restricted to Chué Spring, ca. 26° 15'S, 23° 10'E, on the Makuba range, Bechuanaland).

Remarks: de Blainville 1817: 163, 1 pl (letter from Burchell describing *R. simus*, identical to Burchell 1817). Desmarest 1822, suppl. pl. 12 fig. 5 (figures by Burchell). E. Desmarest 1819: 246 (abstract from Burchell's letter). Gray 1868: 1028 (horns figured in Burchell 1817 do not belong to this species). Jardine 1836: 186-188 (translation of Burchell 1817). Lesson 1842: 159 (*R. simus* a variety of *R. bicornis*). Owen-Smith 1973: 12-13 (history). Schinz 1824: 290 (*R. simus* single-horned). von Schreber 1835: 342 (a doubtful species).

Taxon considered valid:

Atelodus simus; Pomel 1853. - Brandt 1878a, b, c, 1879. Flower 1876, 1891. Steinmann & Döderlein 1890.

Ceratohinus simus; Grassé 1955.

Ceratotherium simum; Gray 1868, 1869b. - (Note: This combination generally used after 1960, except cf. *Diceros simus*.) - Babault 1949. Blancou 1958a, b. Bourgoin 1955. Breuning 1924. Cave 1958b, 1959. Cave & Allbrook 1958. Cooke 1950. Fraser 1958. Frechkop 1936. Grzimek 1958, 1960a. Jeannin 1945. Jentink 1887, 1892. Knobel 1958. H. Lang 1920, 1924b. Lavauden 1934. Malbrant 1936. Mauny 1956. Stevenson-Hamilton 1950. Weber 1904. Wilhelm 1950. Zeuner 1934. Zukowsky 1924.

Ceratotherium simum simum; Heller 1913. - (Note: This combination generally used after 1960, except *Diceros s. simus*.) - Allen 1939. van den Bergh 1955. Bigalke 1947a. Bigalke et al. 1950. Dekeyser 1955. Harper 1945. Hill & Carter 1941. Shortridge 1942.

Dicerorhinus simus; Arambourg 1962.

Diceros simus; Thomas 1901. - Ansell 1960a. Brand 1964a. Child & Savory 1964. Cooke 1964. Fiennes 1966. Haagner 1920. Maliepaard & de Vos 1961. van der Merwe 1962. L. Smith 1968. Young 1965a.

Diceros simus simus; Pienaar 1963. - Crandall 1968. Smithers 1968. Wallach 1969.

Diceros (Ceratotherium) simum; Ellerman et al. 1953. - R.C. Bigalke 1958. Ellerman 1954.

Diceros (Ceratotherium) simum simum; Ripley 1958.

Opsiceros simus; Gloger 1841.

Rhinaster simus; Gray 1862.

Rhinoceros simus Burchell 1817. - (Note: This combination generally used for the white rhinoceros before 1868, with few exceptions mentioned elsewhere.) - Augiéras 1935. Berger 1910a. Brehm 1877. Breuil 1923. Bryden 1889, 1892, 1893. Buckley 1876. Cabrera 1911. Chapman 1921. Coryndon 1894. Drummond 1875, 1876. Duncan 1892. Flower & Lydekker 1891. Fitzsimons 1920. Grant 1872. Heck 1896. Hobley 1926. Jentink 1890. Johnston 1906a. Lydekker 1881, 1893, 1911a. Malbrant 1930. Möller 1974.

Müller-Liebenwalde 1895. Nehring 1901. Nicholson & Lydekker 1889. Noack 1889. Noll 1873. Osborn 1900. Peringuey 1909. Potter 1949. de Pousargues 1897. Reid 1952. Renshaw 1904. Scherren 1903. Schlegel 1857. Selater 1864a, 1870, 1872c, 1873a, 1886a, b, 1890, 1900, 1903, 1904. W. Selater 1891, 1900. Selous 1876, 1881, 1892. P. Selous 1897. Stockley 1948. Thomas 1900. Trouessart 1898. Vogt 1884. Ward 1896. Ward & Lydekker 1912.

Rhinoceros (Atelodus) simus; Zittel 1891. - Woodward 1898.

Rhinoceros (Ceratotherium) simus; Schouteden 1911.

Rhinoceros (Diceros [Ceratotherium]) simus; Friant 1948, 1950.

Rhinoceros (Diceros) simus; Foenander 1952.

Rhinoceros (Diceros) simus simus; Lydekker 1916. - Dollman 1921.

Campbell's Rhinoceros

Remarks: Campbell 1821, 1822 (animal collected near Mashow, S. Africa, with a long straight anterior horn and a much smaller posterior horn). Gray 1868: 1029 (as *R. simus*). Home 1821: 272, 1822: 38-40, 1824 (information on Campbell's specimen).

Note: The animal is discussed and figured in John Campbell, Travels in South Africa, second journey, 1822, vol. 1: 294-296, pl. facing p. 294 (quoted and reproduced by A. Smith 1968: 106, pl. 2).

5.2.4 *Lapsus in specific names*

Rhinoceros sinusus, Smith 1836: 40 (corrected in Smith 1837: 9). Harris 1838: 376, 1839 (as synonym of *R. simus*).

Ceratotherium simum simum burchelliensis, Hayes 1964.

5.2.5 *Lists of synonyms*

Ansell 1967: 3. Brandt 1878a: 55-56. Ellerman et al. 1953: 164. Groves 1972: 1. Lydekker 1916: 55-56. Owen-Smith 1973: 15.

5.3 NAMES IN VERNACULAR

Best & Raw 1975: 160. Bourgoin 1955: 65. Bryden 1893: 490. Fitzsimons 1920: 207. Frechkop 1936: 12. Gatti 1965: 75. Hartmann 1868: 365. Jeannin 1945: 106. Kirby 1920: 242. Oswell 1847. Oswell & Vardon 1847: 182, 183. Owen-Smith 1973: 16. Player & Feely 1960: 21. Reid 1952. Rode 1944: 165. Shortridge 1942: 71.

5.4 EXTERNAL MORPHOLOGY

5.4.1 *Appearance*

Best & Raw 1975: 161. Bigalke et al. 1950. Boitard 1842: 405. Borchers 1979: 220. Brehm 1877: 518. Burton 1962: 210. Chenu & Desmarest 1858: 10. Crandall 1968: 508. Daniell 1805, pl. 30. Dorst & Dandelot 1970: 169. Duncan 1892: 324. Fitzsimons 1920: 212. Frechkop 1936: 12. Gatti 1965: 75. Giebel 1855: 202. Grassé 1955: 1111-1113. Groves 1972: 1-2. Guggisberg 1966a: 86. Haltenorth et al. 1979: 118. Harris 1839: 371. Heck 1896: 1022. Heppes 1958a: 30, 1958b: 274. Jeannin 1951: 118. Kirby 1920: 226. Lang 1920: 73. Lavauden 1934: 425. Lydekker 1892b. Noll 1873: 142. Oswell 1900: 138. Owen-Smith 1973: 81. Player & Feely 1960: 6. Roosevelt & Heller 1915, II: 659, 667. Schaurte 1969: 158 (at birth). Schinz 1824: 290. Schomber 1963: 29. Selater 1886a. Selous n.d.: 186.

5.4.2 *Colour*

Harris 1839: 371. Heck 1896: 1022. Heller 1913: 21. Jentink 1890: 244. Kirby 1920: 229. Lang 1920: 72. Maydon 1932: 116. Player 1972: 133. Roosevelt & Heller 1915, II: 662, 670. F.C. Selous in Bryden 1899: 65.

5.4.3 *Explanation of name 'white'*

Berger 1924: 145. van den Bergh 1955: 132. Best & Raw 1975: 161. van Bruggen 1965b: 76. Fitzsimons 1920: 207. Gatti 1965: 75. Guérin 1980: 29. Hayman 1956. Heppes 1958b: 274. von Heuglin 1869: 301. Kirby 1920: 229. Lang 1920: 75. Lavauden 1932: 507. Owen 1956: 27. Owen-Smith 1973: 14. Player & Feely 1960: 7. Renshaw 1904: 131-133. Reynolds 1968a: 9.

5.4.4 *Footprints*

Bigalke et al. 1950: 525 (growth of hoofs). Kirby 1920: 227. Lang 1920: 86.

5.4.5 *Hair*

Bigalke et al. 1950. Cave 1958a, 1969: 251-254 (body hair, eyelashes, absence of facial vibrissae). Groves 1967b: 222, 1972: 2-3. Heller 1913: 22. Kubiak & Dziurdzik 1973 (histology of hair from ear). Player & Feely 1960: 9.

5.4.6 *Horn*

Bigalke et al. 1950: 524. Foster 1960: 32. Groves 1971: 250. Guggisberg 1966a: 87. Hediger 1970, 1977: 14 (additional horn on shoulders). Heller 1913: 35 (single-horned specimen). Klös 1969b (breaking off and growth). Lang 1920: 73. Lavauden 1934: 425 (Lado female not single-horned). Lynch et al. 1973 (structure). Oswell 1900: 138.

Horn measurements: Best & Raw 1975: 488-489. Bigalke et al. 1950. Brocklehurst 1931: 110. Bryden 1893: 493. Cooke 1950: 404. Coryndon 1894: 332. Haltenorth & Trense 1956: 413. Hartmann 1868: 365. Heller 1913: 35. Jeannin 1951: 118. Lang 1923: 158. Lavauden 1932. Lydekker 1892b, 1907c: 73. Scherren 1903. Schillings 1925: 111. Selater 1903: 195. F.C. Selous in Bryden 1899: 62-64.

5.4.7 *Nuchal hump*

Alexander & Player 1965. Bigalke et al. 1950: 523. Groves 1972: 2-3.

5.4.8 *Size*

Benzon 1947. Berger 1910a: 372 (Uganda), 1910b: 346. Bourgoïn 1955: 65. Brocklehurst 1931: 110. Bryden 1893: 494. Burton 1962: 210. Coryndon 1894: 329. Crandall 1968: 508. Dorst & Dandelot 1970: 169. Fitzsimons 1920: 212. Foster 1960: 34. Frädrieh & Frädrieh 1973: 192. Groves 1972: 1-2. Guggisberg 1966a: 86. Haltenorth et al. 1979: 106. Harris 1839: 371. Heller 1913: 32. Heppes 1958a: 30, 1958b: 274. Ionides 1953a: 128. Jeannin 1951: 118. Jentink 1890: 243. Kirby 1920: 228. Lang 1920: 74. Maydon 1932: 117. Mentis 1970: 375. Owen-Smith 1973: 84-87. Player 1967: 138, 1972: 71, 73, 91. Player & Feely 1960: 6. Rode 1944: 166. Roosevelt & Heller 1915, II: 667-670. Schinz 1824: 290. Selous n.d.: 186. F.C. Selous in Bryden 1899: 66. Silberman & Fulton 1979: 7. Ward 1896: 289.

5.4.9 *Size at birth and growth*

Anon. 1968g. Bigalke 1947a (growth). Bigalke et al. 1950: 520 (growth for 18 months). Dittich 1971: 76, 1972 (growth). Frädrieh & Frädrieh 1973: 192. Owen-

Smith 1973: 93-98 (growth). Player 1967: 148 (growth). Player & Feely 1960: 8 (growth). Roney 1972. Schaurte 1969: 484 (after 6 days). Wallach 1969 (growth). Wilson 1969: 8 (after 7 days).

5.4.10 *Skin*

Allbrook et al. 1958: 51P. Bigalke et al. 1950: 522.

5.4.11 *Age classes*

Groves 1975: 201-205 (skulls). Heller 1913: 22. Owen-Smith 1973: 93.

5.4.12 *Individual recognition*

Selous 1881 (individual variation in shape of horn).

5.4.13 *Sexual dimorphism*

Groves 1975: 201-205 (skulls). Guérin 1980: 157, 158 (males larger than females). Harris 1839: 371 (female smaller). Heller 1913: 77 (horns). Lavauden 1934: 425 (female not single-horned). Loose 1975: 26 (absent in skulls).

5.5 ANATOMY

5.5.1 *Review and general dissection*

Aumonier & Cave 1960 (visceral histology). Grassé 1955: 1108-1118. Groves 1972: 3 (summary). Owen-Smith 1973: 88-91.

5.5.2 *Organs*

Epipharynx: Cave 1974a.

Kidney: Meinertz 1974: 710.

Lymph: Cave & Aumonier 1962a (lymph node), 1964b.

Musculature: Kingdon 1979, fig. p. 85.

Parathyroid: Cave 1976b. Cave & Aumonier 1966 (histology).

Penis: Cave 1964b, 1966. Cave & Aumonier 1964c.

Postcava: Cave 1975.

Salivary glands: Cave 1982.

Skin: Cave 1958a. Cave & Allbrook 1958, 1959.

Sweat gland: Groves 1972: 3 (apocrine).

Temporo-ptyergoid ligament: Cave 1979b: 524.

Thyroid: Cave 1976b, c.

Tongue: Cave 1977, 1980 (musculature).

Tonsils: Cave 1979a: 486-493.

5.6 OSTEOLOGY

5.6.1 *Skull*

Cave 1959: 2 (foramen ovale), 1965: 505-507 (lacrimal epiphysis). Chapman 1921: 409 (bony projection in front of eye). Friant 1948 (articulation of lower jaw). Gray 1868: 1028. Groves 1972: 3. Guérin 1980: 33-54. Heller 1913: 22-29. Loose 1975: 8-10, 14 (characters, otic region). Owen-Smith 1973: 87. Thenius 1955a (ossification of nasal septum).

5.6.2 *Skull measurements*

Gray 1868: 1032. Groves 1972: 3, 1975: 204. Guérin 1980: 48, 52. Heller 1913: 28. Loose 1975, tab. 9 (Zeuner's angles in quartiles). Nehring 1901.

5.6.3 *Dentition*

de Blainville 1846: 51-58. Cooke 1950: 404. Dittrich 1974: 293 (eruption of milk teeth). Groves 1972: 3. Guérin 1980: 54-73 (description, measurements). Haltenorth et al. 1979: 106. Heller 1913: 22. Hickman 1979 (inverted PM₁ due to blow). Loose 1975: 8. Owen 1845: 589ff. Owen-Smith 1973: 87. Player & Feely 1960: 8 (eruption of milk teeth). Roosevelt & Heller 1915, II: 659. Wallach 1969 (eruption of molars).

5.6.4 *Postcranial skeleton*

Groves 1972: 3. Guérin 1980: 74-152 (descriptions of bones, measurements). Heller 1913: 15 (vertebral formula). Pouchet & Beauregard 1889: 198. Zeuner 1934: 35 (position of head).

5.7 PHYSIOLOGY

Allbrook et al. 1958 (rectal temperature, pulse rate). Groves 1972: 4 (body temperature, heart rate, respiration). Hiley 1977 (thermoregulatory response). Jones 1979: 242, 245 (vit. A and copper levels; haemoglobin and serum biochemistry). Kirby 1920: 240 (perspiration). Nelson 1978: 767 (blood parameters). Osterhoff & Keep 1970 (blood protein). Osterhoff et al. 1972: 361 (haemoglobin). Owen-Smith 1973: 91 (body temperature, pulse rate). Seal et al. 1976 (blood constituents). Silberman & Fulton 1979: 7 (body temperature, blood constituents). Thomson et al. 1949 (rectal temperature). Wallach 1969 (heart rate, rectal temperature).

5.8 GENETICS

Groves 1972: 5 (karyotype). Heinichen 1967, 1969, 1970: 68-72 (karyotype, 2n=82, chromosomes). Owen-Smith 1973: 93 (chromosomes).

5.9 DISTRIBUTION AND STATUS

5.9.1 *General reviews and reports*

Babault 1949: 10. Behr & Meissner 1959: 160-161. Duncan 1892: 324 (Central Africa). Groves 1972: 2 (map), 1975: 201. Guggisberg 1966a: 82, 84. Haltenorth & Trense 1956: 207. Haltenorth et al. 1979: 106. Heck 1896: 1022. Jeannin 1951: 123, 129-131. Joleaud 1931: 680-684. Kingdon 1979: 107. Klös & Frese 1981a: 18 (map). Llopis 1974c. Owen-Smith 1973: 22-24. Renshaw 1904: 148-150 (early reports on northern subspecies). Sidney 1965: 51-61 (review).

5.9.2 *Status in general*

Anon. 1963c. Heymans & Colyn 1981: 159. Hillman 1980a, b, 1981. Kirk 1968: 151. Klingel 1979 (present status review). Lang 1920: 91, 1924b: 319. Maliepaard & de Vos 1961: 150-151. Schomber 1959: 552, 1966: 225. Simon 1966-1971. Thornback 1981b.

5.9.3 *General reports on Southern Africa*

Ansell 1967: 1-2. Bothma 1975: 89. van Bruggen 1965b: 76-77. Dolan 1971. Duncan

1892: 324. Groves 1972: 2. Guggisberg 1966a: 77-80. Heller 1913: 38. Heppes 1958b: 273. Kirby 1920: 224. Lang 1920: 76. Murray 1866: 338. Player 1972: 107 (map). Player & Feely 1960: 3-6. Roth 1967. Sclater 1886a. F.C. Selous in Bryden 1899: 52-55. Simon 1966.

5.9.4 *Angola and Namibia*

Review: Sidney 1965: 60.

Records: Ansell 1959a (S.E. Angola and N. Namibia). Barnard 1952 (Kaokofeld). Behr & Meissner 1959: 161 (S.E. Angola). Coryndon 1894: 330 (Angola). Grzimek 1958: 118 (Angola, status). Maliepaard & de Vos 1961: 151 (S.E. Angola). Möller 1974: 102 (S. Angola). Schomber 1959: 550 (Kaokofeld improbable). Selous 1881 (between Okavango and Cunene). Steinhardt 1920: 42 (localities Namibia; seen once N.E. Kaokofeld).

5.9.5 *Botswana*

Ansell 1959a (former occurrence). Hillman 1980a: 71 (Chobe N.P.). Smithers 1968: 96 (wanderers from introduced population in Wankie N.P., S. Rhodesia). 1971: 405 (early reports, extinct 1880-1890; wanderers from Wankie N.P.).

5.9.6 *Cameroon*

Jeannin 1930: 165 (natives suggest occurrence in north). Lavauden 1932 (possible occurrence).

5.9.7 *Central African Republic (A.E.F.)*

Review: Harper 1945: 410. Schomber 1966: 222-223, map 3. Sidney 1965: 54-55. *Status:* Blancou 1958b: 404 (extinct). Fitter 1968: 33, 1974b: 445. Grzimek 1958: 118. Hillman 1980a: 71. Owen-Smith 1973: 19. Schomber 1963: 31. Simon 1971. 'C.A.R.' only: Ansell 1967: 2. Maydon 1932: 117.

Records: Augières 1935: 62 (north of Mbomou). Behr & Meissner 1959: 160 (Aouk-Aoukat, Birao). Blancou 1948: 10-11 (until 1935), 1958a: 313 (no records for 20 years), 1960: 101 (N.E. Oubangui). Bourgoin 1955: 65 (Oubangui), 1958: 404 (Oubangui). Fitter 1968: 33 (Oubangui). Groves 1972: 2 (Goz Sassulko N.P., Upper Oubangui). Grzimek 1958: 117 (Goz-Sassulko N.P.). Jeannin 1945: 108 (Oubangui). Lavauden 1932 (localities), 1934: 431 (localities in east). Malbrant 1936: 26 (east of Oubangui). Rode 1944: 167 (Oubangui Chari). Zwilling 1940: 367-368 (Birao, Aouk).

5.9.8 *Chad*

Review: Schomber 1966: 223-225, maps 3, 4. Sidney 1965: 53-54.

Status: Blancou 1958a: 313 (no records for 20 years).

'Chad' only: Ansell 1967: 2. Schouteden 1911: 120.

Records: Blancou 1935a: 60 (absent), 1948: 10 (Oubangui-Chari, until 1935), 1960: 101 (S.E. Chad). Groves 1972: 2 (Lake Iro, R. Salamat). Lavauden 1932 (localities), 1934: 431 (localities). Malbrant 1930: 355 (localities), 1936: 26 (former localities). Trouessart 1909 (Sudan to Lake Chad). Zwilling 1940: 367-368 (Goz-Beida, Mongororo).

5.9.9 *Kenya*

Translocation: Anon. 1966a (from Zululand to Meru N.P., 6 animals). Anon. 1978b (late of Meru population). Foster 1967: 169 (from S. Africa to Meru N.P., 1966).

5.9.10 *Malawi*

Kirby 1920: 224 (Mwanza bush, skulls found in 1904).

5.9.11 *Mozambique*

Review: Sidney 1965: 61.

Status: Hillman 1980a: 72.

Translocation: Anon. 1969a (to Gorongosa and Maputo). Anon. 1970d (to Mozambique). Smithers & Tello 1976: 111 (reintroductions 1967-1969).

Records: Ansell 1970. Bigalke 1970. Johnston 1906a: 292 (horns, north). Maughan 1910: 247 (absent). Smithers & Tello 1976: 111 (south, until ca. 1935).

5.9.12 *South Africa*

Review: Owen-Smith 1973: 19-33. Sidney 1965: 59-60.

Status: Bourquin et al. 1971: 35 (Zululand). van Bruggen 1965b: 78. Fitter 1968: 34. Grzimek 1958: 117. Hillman 1980a: 72. Jacobi 1970b (Natal 1900-1968). Maydon 1932: 116. Mentis 1970 (Umfolozzi). Owen-Smith 1973: 25-33, 678. Player 1967: 149. Schaurie 1962. Sidney 1965: 59. Simon 1966. Vincent 1969a (Zululand 1959-1968). Wallach 1966: 871 (1961, 1965).

Hunting: Coryndon 1894: 332-334. Gatti 1965: 76-78. Giebel 1855: 202. Selous 1893: 125-135.

Translocation: Anon. 1968f (Loskop Dam G.R., birth). Anon. 1973i (to Kruger N.P.). Bigalke 1968: 426 (to Loskop Dam G.R., births). Dixon 1964: 48 (to Mkuzi G.R.), 1966: 32 (to Ndumu G.R.). Grobler 1971 (to Malati G.R.). Jacobi 1970a: 29 (to Kruger N.P.). Pienaar 1970 (to Kruger N.P., 1961-1968, fate of animals). Vincent 1969a: 20, 21 (to Mkuzi and Ndumu G.R.).

'South Africa' only: Daniell 1805, pl. 30. Dollman 1937: 73. Noll 1873: 144.

Records: Borchers 1979: 220 (IJzerfontein, N. Cape province). Bryden 1893: 493 (R. Orange). Cave 1947: 142 (Chue Spring). Cooke 1950: 405 (Kuruman). Harris 1839: 371 (interior after passing Kurrichane). Maydon 1932: 116 (Transvaal, ca. 1830). Oswell & Vardon 1847: 182 (R. Makolwe, N.E. Transvaal). Oswell 1900: 138 (R. Mokolwé). Pienaar 1970: 157 (extermination in Transvaal). Schinz 1824 (Lataku, Betchuanaland). Schomber 1959: 550 (Cape province, no good reports). Selous n.d.: 184 (localities). Stevenson-Hamilton 1950: 45 (Kruger N.P., until 1850). Wahlberg 1845: 23 (Moriqwa).

Natal, records: Astley-Maberly 1938. Bourquin et al. 1971: 35, fig. 37. Brooks 1876: 110 (beyond R. Tugueh). van Bruggen 1965a (Umfolozzi, Hluhluwe). Cowles 1959 (Hluhluwe). Delegorgue 1847, I: 366-372. Dixon 1964: 48 (Mkuzi G.R.). Feely 1962 (Zululand, 1960). Guggisberg 1966a: 80. Hayman 1956: 4 (Umfolozzi, 1948). King 1962 (Umfolozzi). Kirby 1920: 225 (Umfolozzi). Mentis 1970 (Umfolozzi). Owen-Smith 1973: 678-687 (censuses 1959-1972). Player 1967: 149, 1972. Selous 1893: 125. de St. Croix 1961 (Hluhluwe). Schack 1958. Stott 1963 (Umfolozzi). Vincent 1969a (Hluhluwe-Corridor-Umfolozzi, 1959-1968).

5.9.13 *Sudan*

Review: Groves 1972: 2. Guggisberg 1966a: 84. Harper 1945: 409-410. Owen-Smith 1973: 16-18. Schomber 1966: 214-217, map 1. Sidney 1965: 55-56.

Status: Curry-Lindahl 1972: 263. Fitter 1968: 33. Grzimek 1958: 118. Hillman 1980a: 72. Owen-Smith 1973: 18. Reid 1952. Simon 1966, 1967, 1970, 1971. Stonehouse 1981: 62.

Hunting: Degerbøl 1949: 132-158. Mackenzie 1953 (rhino traps made by Dinkas).

Legislation: Chapman 1922: 45. Schomber 1966: 217.

'Sudan' only: Ansell 1967: 2. Blancou 1960: 101. Dollman 1937: 74. Fitter 1974b: 445. Fitzsimons 1920: 207. Lang 1920: 76. Lavauden 1945: 266. Micha 1958: 111. Player & Feely 1960: 20. Savidge 1961: 184. Schomber 1962: 149, 152. Stevenson-Hamilton 1950: 45. Trouessart 1908: 1353; 1909.

Records: Anon. 1946: 36 (south). Anderson 1949: 29 (Southern N.P., along Nile). Benzon 1947 (R. Jur, Bahr el Ghazal). van den Bergh 1955: 129 (Shambe). Blancou 1933: 19 (near Zaire border), 1935a: 60 (Oubangui border), 1958a (Wau, 1946). Bourdillon 1934 (Yei dt.). Brocklehurst 1931: 109 (Mongalla dt.). Chapman 1921: 409, 1922: 45 (Bahr el Ghazal, Bahr el Jebel). Christy 1923: 63, 1924: 152-154 (west bank of Nile; between Yei and Tambura; Haut Nile dt.). Degerbøl 1949: 132 (Gogrial dt.). Ferguson 1949 (Shambe). Foster 1967: 168 (Equatoria, Bahr el Ghazal). Hartmann 1868: 365 (Bahr el Jebel). Heller 1913: 38 (south). von Heuglin 1861: 15 (Bahr el Abiad), 1869: 301 (along Nile). Ionides 1953a: 131 (Yei dt., 1951), 1953b (Kajo Kaji, Yei dt.). Kock 1961: 326 (Nimule). Larken 1947 (Tambura dt.). Lavauden 1932 (localities in south). Mackenzie 1954: 20, map 65 (west bank of Nile). Maydon 1932: 117 (Bahr el Ghazal). Owen 1947 (west of Nile). T. Owen 1949 (Nimule). Reid 1952 (localities in Yei and Moru dts.). Roosevelt & Heller 1915, II: 661, 671 (S.E.). Scherren 1903 (south). Schomber 1963: 31 (south). Scater 1903 (left bank of White Nile). Setzer 1956: 570 (Bahr el Ghazal; near Uganda border). Simon 1971 (Bahr el Ghazal, Equatoria). Stevenson-Hamilton 1919: 348 (along Nile). Thomson et al. 1949 (Tonj, S. Sudan). Wilson 1979: 330 (S. Darfur province, review, not seen after 1951). Wykes 1964: 221 (Yei dt., 1951).

Lado district, records: Berger 1910a: 358, 1924: 144, 162-164. Chapman 1921: 409. Gibbons 1904, II: 221. Heller 1913: 36. Heppes 1958b: 273-280. Kirby 1920: 224 (discovered by Gibbons, 1900). Maydon 1932: 118. Powell-Cotton 1907: 381 (some shot). Roosevelt 1910a: 393ff, 1910b. Schouteden 1911: 119. P. Scater 1900. Selous n.d.: 184. Thomas 1900. Trouessart 1909. Ward & Lydekker 1912.

5.9.14 *Uganda*

Review: Guggisberg 1966a: 83. Harper 1945: 413-414. Kingdon 1979: 108 (map). Owen-Smith 1973: 16-18. Schomber 1966: 217-220, map 2. Sidney 1965: 56-58.

Status: Anon. 1963a, 1965c. Cave 1963a. Curry-Lindahl 1972: 262. Fitter 1968: 33, 1974b: 445. Grzimek 1958: 177, 1960a: 21. Hayes 1964: 6 (in 1954, 1959). Heppes 1958a: 29. Hillman 1980a: 73. Kingdon 1979: 118. Malpas 1980, 1981: 234 (Kabalega Falls N.P. extinct; Ajai G.R. extinct). Micha 1958: 111. Owen 1956: 29. Owen-Smith 1973: 18. Schomber 1963: 31, 1966 (in 1910, 1958, 1962-64). Simon 1971. Tennant 1964. Thomas & Scott 1935: 183. Uganda game dept. 1930: 27 (in 1925, decrease 1925-1928), 1950, 1952, 1953: 35, 1954: 306. Verschuren 1970.

Hunting: Heller 1913: 2-13, 42-51. Roosevelt 1910a: 393-420, 1910b.

Translocation: Anon. 1965e (to Murchison Falls N.P.), 1968d (Murchison Falls N.P., fate of animals), 1973c (Murchison Falls N.P., births). Blower 1963 (to Murchison Falls N.P.). Buechner et al. 1960: 264 (proposed from West Nile dt.). Foster 1967: 168 (to Murchison Falls N.P., 1961, 1964 from West Nile dt.). Hayes 1964 (to Murchison Falls N.P., 1961, 1964), hb. 1971 (Murchison Falls N.P., fate of animals). Henderson 1972 (Murchison Falls N.P., births). Malpas 1980 (to Kabalega Falls N.P., 1961, 1964). Savidge 1961 (from West Madi dt. to Murchison Falls N.P., 1961). Stonehouse 1981: 60 (to Queen Elizabeth N.P.).

Records: Bourdillon 1934 (Rhino Camp). Churchill 1962: 115, 123, frontispiece. Dickinson 1910: 90, 278 (Wadelai, shot by Churchill). Groves 1972: 2 (north of

R. Ora). Gyldenstolpe 1928 (Rhino Camp). Heppes 1958a: 29 (north of R. Ora, map). Heybroek 1926 (Rhino Camp). Temple-Perkins 1956: 6 (Kali-Obongi area).

West Nile and West Madi districts, records: Bere 1957: 11. Brocklehurst 1931: 109. Cave 1963a. Delme-Radcliffe 1904: 61. Foster 1967: 168. Ionides 1953a: 131. Johnston 1902, I: 373. Maydon 1932: 117, pl. 37. Owen 1956: 29. Roosevelt & Heller 1915, II: 660, 671. Schomber 1963: 31. Simon 1971. Stigand 1909: 280. Thomas & Scott 1935: 183. Uganda game dept. 1950, 1952, 1953, 1954.

5.9.15 Zaire

Review: Guggisberg 1966a: 83-84. Harper 1945: 411-413. Owen-Smith 1973: 16-18. Schomber 1966: 220-221, map 3. Sidney 1965: 55.

Status: Bourlière 1965c, tab. 4 (in 1960, 1963). Curry-Lindahl 1966b: 294, 1972. Fitter 1968: 33, 1974b: 445. Foster 1967: 168. Grzimek 1958: 118, 1960a: 21, 1971: 26. Hillman 1980a: 73. Micha 1958: 112. Owen-Smith 1973: 16-18. Schomber 1963: 31, 1966: 220. Simon 1971. Verschuren 1958: 408, 1970, 1971, 1975: 153.

Hunting: Lang 1920: 79-85.

'Zaire' only: Ansell 1967: 2. Bourgoin 1955: 65. Dollman 1937: 74. Fitzsimons 1920: 207. Maydon 1932: 117. Player & Feely 1960: 20, 21. Savidge 1961: 184. Schouteden 1943: 115. Stevenson-Hamilton 1950: 45.

Records: Blancou 1935a: 60 (Oubangui, Sudan border). Christy 1923: 63 (N.E., across border from Maridi-Yambio), 1924: 153 (N.E.). Lang 1920: 76 (Uele), 1924a: 176, 1924b: 319, 322 (N.E. and Uele). Leplac 1925: 48, fig. 27 (R. Uele). Scherren 1903 (north). Schomber 1963: 31 (N.E.). Schouteden 1911: 220 (Uele), 1927: 21, 24, 28 (N.E. of Uele), 1945: 266 (Uele and Kibali-Ituri). Verschuren 1958: 408 (N.E.).

Garamba N.P., records: Backhaus 1960: 308. Bourlière 1965c, tab. 4. Curry-Lindahl 1966a, b, 1972. Fitter 1974b: 445. Foster 1967: 168. Groves 1972: 2. Grzimek 1958: 118, 1960a: 21, 1971: 26. Heymans & Colyn 1981. Ionides 1953a: 131. Micha 1958: 112. Muckar 1977. Owen 1956: 29. Savidge et al. 1977, 1978. Simon 1971. Verschuren 1970.

5.9.16 Zambia

Ansell 1959a (possible former occurrence in west), 1960a: 118 (possibly formerly S.W. Barotse), 1969: 176, 184.

5.9.17 Zimbabwe

Translocation: Condy et al. 1963 (to Matopos N.P. and Kyle Dam G.R., 1962). Rochat & Steele 1968 (reintroductions 1961-1967). Tomlinson 1977 (reintroductions 1961-1975, status 1975). Wallach 1966 (from Umfolozi to Kyle Dam G.R., 1966).

Records: Bryden 1893: 492 (Mashonaland), 1897: 181 (Matabeleland, 1894). Hillman 1980a: 72 (status). Kerr 1887: 290 (spoor in Mashonaland). Kirby 1920: 224 (extinct). Sclater 1890 (S. Mashonaland). Selous 1892 (Mashonaland; 100 miles N.W. of Salisbury; Limuga), 1907: 70 (R. Gwaii). Sidney 1965: 60-61. Tomlinson 1977: 145 (status 1880-1900).

5.9.18 Alleged occurrence East of Nile

Berger 1910b: 344 (one shot in N. Somaliland). Coryndon 1894: 330 (unlikely reports from Somaliland). Delme-Radcliffe 1905: 185 (reports from banks of Kagera require confirmation). Grant 1872: 328 (Karagweh). von Höhnell 1892: 542 (count Teleki shot one on Leikipia plateau in Ethiopia; colour too light for

R. bicornis). Lang 1924a (Karagwe reported by Speke and Grant: wrong identifications). Leplac 1925: 49 (seen east of Nile?). Schouteden 1911: 120 (Somalia, according to Berger). Speke 1863: 619 (Karagwe). Speke in Sclater 1864a: 106 (Karagweh, Uganda, 'rather larger than the black animal'). Thomas 1900 (early records from Ethiopia).

5.9.19 Prehistoric distribution

General: Groves 1972: 2 (fossil record), 1975: 208-211 (fossil record). Guérin 1979: 284 (fossil record), 1980: 166-168 (review). Hooijer 1969 (E. Africa, pleistocene). Lang 1923: 161 (quaternary records).

Egypt: Wilson 1980: 96 (Gilf el Kibir, S. Egypt, 41,450 B.P.).

Ethiopia: Guérin 1976 (Shungura formation, lower Omo basin).

South Africa: Hooijer & Singer 1960 (Hopfield).

Tanzania: Foster 1967: 168 (Olduvai Gorge).

West Africa: Arambourg 1962: 370, 371, 376 (pleistocene of Tunisia). Boule 1900: 8 (Algeria, Lake Karar, fossil teeth).

5.10 ECOLOGY AND BEHAVIOUR

5.10.1 Review and field-work

Brehm 1877: 520ff. Jones 1979: 240. Laurie 1982: 332-337 (comparison with other species). Owen-Smith 1973 (field study), summarized in 1975.

5.10.2 General reports

Best & Raw 1975: 161. Haltenorth & Trense 1956: 207. Owen-Smith 1974a (radios help in field study). Stewart 1971 (placing radio transmitter).

5.10.3 Activity pattern

Coryndon 1894: 331. Dittrich 1971: 78. Fitzsimons 1920: 209. Foster 1960: 31. Groves 1972: 5. Haltenorth et al. 1979: 106. Heller 1913: 41. Heppes 1958a: 32, 1958b: 276. Jeannin 1951: 120. Kirby 1920: 232-234. Lang 1920: 71. Maydon 1932: 117. Micha 1958: 112. Owen-Smith 1973: 166-190. Player 1972: 133. Player & Feely 1960: 13. Roosevelt 1910b: 263. Roosevelt & Heller 1915, II: 664. Schenkel & Lang 1969: 31. Steele 1969: 5. Stevenson-Hamilton 1919: 348.

5.10.4 Associations

Backhaus 1964: 101-103. Burton 1962: 210. Dorst & Dandelot 1970: 169. Foster 1967: 170. W. Foster 1960: 28-31. Guggisberg 1966a: 89. Haltenorth et al. 1979: 105. Heller 1913: 40. Heppes 1958a: 31, 1958b: 275. Ionides 1953a: 130. Jeannin 1951: 120. Kingdon 1979: 112-115. Kirby 1920: 231. Malbrant 1936: 26 (no groups). Owen-Smith 1972b: 175, 1973: 229-242, 478-520, 1974b: 342, 1975: 341-345, 371-372. Roosevelt 1910b: 264. Roosevelt & Heller 1915, II: 664. Schenkel & Lang 1969: 30. Selous n.d.: 186. Underwood 1982.

5.10.5 Defecation and urination

van den Bergh 1955: 149-151. Bigalke et al. 1950: 526. Dittrich 1971: 77. Foster 1960: 30. Groves 1972: 5. Micha 1958: 113 (ritualized urination). Owen-Smith 1973: 103-107, 260-272 (ritualisation), 1975: 362-366. Player 1972: 140. Player & Feely 1960: 16, 17.

5.10.6 *Dung heaps*

Backhaus 1964: 97. Coryndon 1894: 332. Dales 1966 (marking territory). Fitzsimons 1920: 211. Guggisberg 1966a: 93. Heller 1913: 41. Heppes 1958b: 277. Hutchinson & Ripley 1954: 179. Kirby 1920: 235. Lang 1920: 86 (absent). Maydon 1932: 117. Micha 1958: 114. Owen 1956: 30. Player 1972: 140. Player & Feely 1960: 16. Potter 1947: 384, 1949: 137. Roosevelt 1910b: 264. F.C. Selous in Bryden 1899: 64.

5.10.7 *Dung scattering*

Coryndon 1894: 332 (absent). Foster 1960: 29. Heller 1913: 41 (absent). Player & Feely 1960: 17.

5.10.8 *Food*

Babault 1949: 10. Berger 1910b: 344. Bigalke et al. 1950: 527 (food, coprophagy). Brocklehurst 1931: 109. Burton 1962: 210. Dorst & Dandelot 1970: 170. Foster 1967: 170. W. Foster 1960: 128. Guérin 1980: 178. Groves 1972: 5. Guggisberg 1966a: 91. Haltenorth et al. 1979: 106. Heller 1913: 41. Heppes 1958a: 31, 1958b: 276. Hutchinson & Ripley 1954: 179. Ionides 1953a: 130. Jeannin 1951: 121. Jones 1979: 241. Kingdon 1979: 109. Kirby 1920: 236. Lang 1920: 75, 85. Letley 1962. Loose 1975: 29. Malbrant 1936: 26. Nelson 1978: 764. Owen 1956: 30. Owen-Smith 1973: 112-142 (diet), 142-151 (drinking); 1975: 339. Player 1962. Player & Feely 1960: 12. Roosevelt 1910b: 263. Roosevelt & Heller 1915, II: 664. Schütte 1970. Sclater 1872c: 428. Selous n.d.: 186. F.C. Selous in Bryden 1899: 59. Wilson 1969: 9. Zeuner 1934: 35.

5.10.9 *Gait*

Foster 1960: 33. Lang 1920: 73. Owen-Smith 1973: 98-102.

5.10.10 *Habitat*

Burton 1962: 210. Christy 1924: 152. Dorst & Dandelot 1970: 169. Groves 1972: 4. Guggisberg 1966a: 92. Haltenorth et al. 1979: 106. Jeannin 1951: 120. Kingdon 1979: 109. Kirby 1920: 234. Lang 1920: 69. Malbrant 1936: 26. Player & Feely 1960: 10-12. Schenkel & Lang 1969: 30. Schouteden 1927: 21. Sclater 1872c: 428. Zeuner 1934: 35.

5.10.11 *Home range*

Owen-Smith 1972b: 275, 1973: 190-225, 278-352, 1974b: 344, 1974c, 1975: 345-352, 370-375.

5.10.12 *Horn use*

Bigalke et al. 1950: 527 (tossing instinct). Foster 1960: 32. Owen-Smith 1971a, 1973: 153 (rubbing). Player 1972: 134 (rubbing). Skead 1971 (rubbing).

5.10.13 *Learning and memory*

Groves 1972: 5.

5.10.14 *Longevity*

Groves 1972: 4. Guggisberg 1966a: 59. Haltenorth et al. 1979: 107. Jeannin 1951: 122. Mentis 1972: 7. Owen-Smith 1973: 691-699. Player & Feely 1960: 18. Vincent 1969a.

5.10.15 *Play*

Dittrich 1971: 78.

5.10.16 *Population structure*

Bourlière 1965c, tab. 4 (biomass). Feely 1962. Groves 1972: 4. Mentis 1970 (biomass), 1972: 7. Micha 1958: 112. Owen-Smith 1973: 688-746. Player & Feely 1960: 17. Vincent 1969a.

5.10.17 *Relations with men*

Anon. 1946. Babault 1949: 10. Backhaus 1964: 96. Berger 1910b: 345. Brocklehurst 1931: 109. Burton 1962: 210. Coryndon 1894: 331. Dorst & Dandelot 1970: 170. Fitzsimons 1920: 211. Guggisberg 1966a: 96. Heller 1913: 40. Heppes 1958a: 31, 1958b: 275. Jeannin 1951: 122. Kirby 1920: 230. Lang 1920: 86. Malbrant 1936: 26. Oswell 1900: 141-145. Owen 1956: 27. Owen-Smith 1973: 665-677. Roosevelt & Heller 1915, II: 665. Schenkel & Lang 1969: 31. Stott 1963. Uganda game dept. 1950: 98. Wood 1851: 759.

5.10.18 *Relations with other animal species*

General: Haltenorth et al. 1979: 106. Lang 1920: 87. Owen-Smith 1973: 649-658, 661-665 (predation); 1975: 340.

Birds symbiosis: Groves 1972: 4. Guggisberg 1966a: 95. Kirby 1920: 240. Lang 1920: 88. Micha 1958: 112. Player & Feely 1960: 14. Schenkel & Lang 1969: 30. Stutterheim 1980 (pied crow).

Elephant: Backhaus 1964: 96.

Lion: Fitzsimons 1920: 210.

Other rhinoceros species: Anon. 1966b (fight with *D. bicornis*). Deane 1960 (peaceful meeting). Guggisberg 1966a: 89. Leuthold 1977: 127 (agonistic behaviour). Owen-Smith 1973: 655-658. Schenkel & Lang 1969: 30. Steele 1960 (*D. bicornis* gives way to *C. simum*).

Ungulates: Backhaus 1964: 97.

5.10.19 *Salt licks*

Owen-Smith 1973: 151 (mineral requirements).

5.10.20 *Senses*

Dorst & Dandelot 1970: 170. Fitzsimons 1920: 210. Foster 1960: 34. Groves 1972: 4. Guggisberg 1966a: 95. Haltenorth et al. 1979: 106. Heller 1913: 40. Jeannin 1951: 121. Kingdon 1979: 110. Kirby 1920: 236-238. Lang 1920: 85. Micha 1958: 112. Owen-Smith 1973: 109-111. Player & Feely 1960: 7. F.C. Selous in Bryden 1899: 60.

5.10.21 *Sleep*

Owen-Smith 1973: 102-103.

5.10.22 *Social behaviour*

General: Backhaus 1964: 103-105 (encounters). Leuthold 1977: 127, 222-224. Owen-Smith 1972b: 276, 1973: 390-478 (encounters), 1974b, 1975: 340.

Communication: Owen-Smith 1973: 322-390 (visual, tactile and olfactory displays). 1975: 362-366.

Fights: Heppes 1958b: 277. Hickman 1979. Kingdon 1979: 116. Lang 1920: 87. Player 1972: 139. Player & Feely 1960: 16. Schenkel & Lang 1969: 30.

5.10.23 *Speed*

Foster 1960: 34. Groves 1972: 5. Guggisberg 1966a: 89. Heller 1913: 41. Jeannin 1951: 121. Kingdon 1979: 110. Player & Feely 1960: 14. Selous n.d.: 186.

5.10.24 *Territory*

Backhaus 1964: 97. Dales 1966 (male territorial). Hutchinson & Ripley 1954: 179. Owen-Smith 1971b, 1972b: 277-279, 1973: 242-278, 288-295, 608-636, 644-648 (territory, changes, evolution), 1974b: 343-346, 1974c, 1975: 366-369, 370-379.

5.10.25 *Voice*

Dittrich 1971: 78. Dorst & Dandelot 1970: 170. Foster 1960: 30. Groves 1972: 5. Guggisberg 1966a: 99. Haltenorth et al. 1979: 106. Jeannin 1951: 121. Kingdon 1979: 112. Kirby 1920: 240. Owen-Smith 1973: 298-321. Player & Feely 1960: 14. Schenkel & Lang 1969: 30.

5.10.26 *Wallowing and bathing*

Foster 1960: 31. Groves 1972: 5. Guggisberg 1966a: 94. von Heuglin 1869: 302. Kirby 1920: 231. Lang 1920: 75. Natal Parks board 1953: 21 (stuck in small river). Owen-Smith 1973: 151-157, 1975: 339-340. Player 1972: 134. Player & Feely 1960: 13. Schouteden 1927: 22.

5.10.27 *Weapons*

Groves 1972: 5. Pitman 1956: 196.

5.11 REPRODUCTION

5.11.1 *Review*

Frechkop 1936: 13. Groves 1972: 4. Haltenorth et al. 1979: 107. Jones 1979: 242-243 (breeding in zoos). Klös & Frese 1981a: 16-17 (zoo animals). Owen-Smith 1973: 521-576, 1975: 369-371.

5.11.2 *Age of sexual maturity*

Frädrieh & Frädrieh 1973: 192. Heller 1913: 41. Heppes 1958b: 278. Mentis 1972: 6. Rawlins 1979. Vincent 1969a: 19.

5.11.3 *Birth*

Eriksen 1977. Owen-Smith 1973: 562-568.

5.11.4 *Calving interval*

Heller 1913: 42. Jones 1977: 127. Kingdon 1979: 117. Klös & Frese 1978. Lang 1920: 88. Mentis 1972: 6. Rawlins 1979. Vincent 1969a: 19.

5.11.5 *Courtship and copulation*

Backhaus 1964: 105. Eriksen 1977. Frädrieh & Frädrieh 1973: 192. Heppes 1958b: 278. Kingdon 1979: 117. Leuthold 1977: 152. Mentis 1972: 6. Owen-Smith 1972b: 277, 1973: 521-526, 536-548, 556-562, 1974b: 347-348. Player 1972: 183-186. Player & Feely 1960: 15. Schenkel & Lang 1969: 31. Wilson 1969: 9.

5.11.6 *Gestation*

Anon. 1968c, g. Asdell 1964: 534. Burton 1962: 210. Eriksen 1977. Foster 1960: 33.

Frädrieh & Frädrieh 1973: 192. Guggisberg 1966a: 97. Heppes 1958a: 35, 1958b: 278. Mentis 1972: 6. Owen-Smith 1973: 526. Player 1972: 139. Player & Feely 1960: 15. Potter 1947: 384. Schaurte 1969: 158. Schenkel & Lang 1969: 31. L. Smith 1968. Vincent 1969a: 19. Wilson 1969: 9.

5.11.7 *Hand-rearing*

Hill 1973a. Wallach 1969.

5.11.8 *Mating season*

Asdell 1964: 534. Fairall 1968: 201, fig. 18. Guggisberg 1966a: 96. Heller 1913: 42. Heppes 1958a: 35, 1958b: 278. Kingdon 1979: 117. Kirby 1920: 242. Klös & Frese 1981a: 16 (in zoos). Lang 1920: 88. Owen-Smith 1972b: 277, 1973: 529-536, 1974b: 317. Player 1972: 139. Rawlins 1979.

5.11.9 *Milk composition*

Dittrich 1971: 75. Groves 1972: 3.

5.11.10 *Mother's behaviour to child*

Babault 1949: 10. Dittrich 1971: 76, 79, 1972. Fitzsimons 1920: 210. Foster 1960: 28, 33. Guggisberg 1966a: 97. Maydon 1932: 117. Owen-Smith 1973: 568-576, 1974b: 349. Player 1972: 67. Player & Feely 1960: 15.

5.11.11 *Twins*

Player 1972: 95. F.C. Selous in Bryden 1899: 64 (presumed twins).

5.12 PARASITES

Babault 1949: 10 (Oestridae). Baker & Keep 1970: 41, 44 (Zululand, ticks). Bequaert 1916: 380-387 (review Oestrid larvae; larvae of *Gyrostigma pavesii* from stomach, Congo). van den Bergh 1955: 139 (no parasites found). R.D. Bigalke et al. 1970 (blood samples; *Babesia* sp. and *Theileria*-like piroplasm). Cobbold 1879: 401 (*Gastrophilus rhinocerotis*). Condy et al. 1963: 99 (fly larvae, nematodes). Groves 1972: 4 (ticks, flies). Guggisberg 1966a: 94 (list of ticks, biting flies). Keep 1970: 54 (*Babesia*). Lang 1976: 166 (in zoo animals). Lang 1920: 88, 89 (internal parasites: *Tabanids*, *Lyperosia*, *Gyrostigma*). Neitz 1965: 297 (Platyhelminthes: *Anoplocephala magna* sporadic). Owen-Smith 1973: 659-661 (review). Player 1972: 71, 191 (*Gyrostigma*, *Amblyomma*). Rodhain & Bequaert 1918: 448 (*Gyrostigma pavesii*). Roth 1968: 77 (*Strongylidae*, *Spiruridae*, *Oxyuri*). Silberman & Fulton 1979: 9 (in zoo animals). Zumpt 1962 (*Gyrostigma pavesii*), 1964 (ectoparasites, Zululand - review), 1965 (review).

5.13 VETERINARY STUDIES

5.13.1 *Review*

Jones 1979: 246-250 (review of diseases in zoo animals). Lang 1976 (review of diseases in zoo animals). Owen-Smith 1973: 659. Silberman & Fulton 1979.

5.13.2 *Records*

Groves 1972: 5 (eye lesions, anthrax). Haigh 1975 (constipation). Keep 1969 (snared animal). Nelson 1978: 766 (zoo animals). Schaller & Pilaski 1979 (pox in adult

female and young male). Schmidt & Hartfiel 1976 (enteric bacterial infection). Thomson et al. 1949 (enteritis). Weiss 1974 (skin infection of *Trichophyton mentagrophytes*). Young 1965a (eye lesion)

5.14 IMMOBILISATION AND TRANSLOCATION

Anon. 1964a (to different reserves). Ansell 1967: 2. van Bruggen 1965b: 79-81. Condy et al. 1963 (drugs, doses). Harthoorn 1962a (drugs, reactions, capture), 1962b (drugs, methods), 1966 (drugs), 1968: 219 (drugs, techniques), 1976: 195-200 (drugs, antidotes, techniques). Harthoorn & Player 1964 (drugs, reactions). Jacobi 1970b. Jones 1979: 244 (restraint in zoos). Keep 1968b (results of Fentanyl), 1971b, 1972, 1973a (drugs). Lang 1976: 165 (drugs). Nelson 1978: 765 (restraint in zoos). Owen-Smith 1973: 32, 92 (drugs, techniques). Pienaar et al. 1966 (capture, methods). Player 1967 (drugs, techniques, destinations), 1972: 245-249 (list of animals translocated from Zululand, 1961-1975). van der Post 1974 (from Umfolozi). Rochat & Steele 1968 (drugs, capture, transport, release). Steele 1969 (drugs, methods). Vincent 1968 (482 animals from Umfolozi, 1961-1968), 1969a, b, 1970a, b, 1971 (list of export). Wallach 1966 (drugs, methods).

5.15 MUSEUM SPECIMENS

General: Best & Raw 1975: 488-489 (present and former owners of record horns). Brandt 1878a: 56 (horn illustrated by Parsons 1743, pl. 3 fig. 6). Campbell 1821, 1822 (head brought to England). Lydekker 1911a (specimens in Liverpool, London, Pretoria, Tring, Wood Norton). Renshaw 1904: 141-149 (11 specimens). Roosevelt & Heller 1915, II: 672 (specimens in Brussels, Hamburg, London, Paris, Washington and Powell Cotton collection).
Amsterdam, Artis zoo museum: Portielje 1940: 43 (head). A.F.J. Portielje in Schillings 1925: 111 (head, skull from Lado).
Berlin, Zoologisches Museum: Berger 1910a: 370 (skin).
Birchington, Powell Cotton museum: Maydon 1932: 119.
Calcutta, Asiatic Society: Blyth 1863b: 138 (anterior horn).
Calcutta, Indian museum: W. Selater 1891: 205 (horn).
Cape Town, South African museum: Bryden 1892 (head), 1893: 492. Müller-Liebenwalde 1895 (stuffed animal). F.C. Selous in Bryden 1899: 56, 58 (2 animals shot at Manyami river, 1882 and one by Carl Rhodes). Ward 1896: 289 (skull).
Cracow, Polish Academy of Sciences: Kubiak & Dziurdzik 1973: 56 (mounted head).
Durban, Natal museum: Kirby 1920: pl. 27.
Exeter, Royal Albert memorial museum: Howes & Bamber 1970: 327.
Grenoble: Lavauden 1934: 432 (horn).
Hamburg, Zoologisches Museum: Nehring 1901 (skull).
Johannesburg, University of Witwatersrand Medical Faculty: Schaurte 1966: 327 (two foetus).
Leiden, Rijksmuseum van Natuurlijke Historie: Jentink 1887: 168, 1890 (skins), 1892: 197. Loose 1975: 36.
Liverpool, Free museum: Gray 1868: 1029 (head).
London, British Museum (Natural History): Dollman 1921: 87 (skull, horns). Gray 1843: 187, 1868: 1028. Groves 1971, figs. 20, 21 (horns). Loose 1975: 36. Selater 1890.
London, Missionary society: Campbell 1821, 1822. Gray 1868: 1029 (Campbell's

specimen). Home 1822: 39 (Campbell's specimen).
London, Royal College of Surgeons: Flower & Garson 1884, nos. 2155-2157. Gray 1868: 1028.
Madrid: Cabrera 1911: 140 (horn).
Marseilles: Lavauden 1932, 1934: 432 (horn).
New York, American Museum of Natural History: Groves 1972, fig. 4 (skeleton). Osborn 1905 (Campbell's skull received 1902).
Paris, Duc d'Orléans: T. Smith 1965: 115 (shot 1921).
Paris, Muséum National d'Histoire Naturelle: Chenu & Desmarest 1858: 10 (skull from Delegorgue). Lavauden 1934: 432 (horns).
Pietermaritzburg, University of Natal: Hickman 1979 (mounted male).
Pittsburgh, Carnegie museum: Gibbons 1904, II: 221 (from Lado).
Pretoria, Natural History museum: F.C. Selous in Bryden 1899: 58 (one shot in Zululand, 1894).
Port Elisabeth: Shortridge 1942: 72 (horns).
Saffron Walden, Museum: Falconer 1868, II: 402 (skeleton, S. Africa).
Stockholm: Lönnberg 1920 (mounted specimen, Wahlberg 1845).
Stuttgart, Naturalienkabinett: Berger 1910a: 380.
Tervuren, Musée de Congo Belge: van den Bergh 1958 (skulls). Schouteden 1911: 124, 1945: 266.
Tring, Rothschild zoological museum: F.C. Selous in Bryden 1899: 58 (one shot by Coryndon, 1893).
Washington, United States National Museum: Hollister 1924 (17 specimens). Setzer 1956: 570.

5.16 EXHIBITION IN CAPTIVITY

5.16.1 Review

Crandall 1968: 508. Eriksen 1977: 33. Grzimek 1960a: 21. Klös & Frädrich 1970 (studbook 31.12.1968), 1971 (studbook 1.11.1971). Klös & Frese 1977 (studbook 31.12.1976), 1978 (statistics), 1981a (studbook 31.12.1980, statistics). Player 1972: 248 (exports from Zululand, 1961-1975). Reynolds 1968: 9. Rookmaaker 1973b: 8 (captive births, 1967-1972). Vincent 1968, 1969b, 1970a, b, 1971 (exports).
 Census of rare animals in captivity, *International Zoo Yearbook* 6: 446, 7: 371, 8: 367, 9: 291, 10: 323, 11: 334, 12: 392, 13: 372, 14: 422, 15: 422, 16: 438, 17: 363, 18: 434, 19: 415, 20: 476, 21: 362. Species of wild animals bred in captivity, *International Zoo Yearbook* 9: 233, 10: 268, 11: 279, 12: 333, 13: 336, 14: 385, 15: 380, 16: 399, 17: 322, 18: 392, 19: 370, 20: 438, 21: 325.

5.16.2 Various collections

Anon. 1968g (Krugersdorp, birth). Crandall 1968: 736 (Loskop Dam G.R., birth 1964). Lang 1976: 168 (circus Knie, 1950-1963). Meyer-Holzappel 1970 (circus Knie, Switzerland, arr. 1966). Schaurte 1969 (Krugersdorp, birth).

5.16.3 Zoological gardens

Antwerp: van den Bergh 1955 (2 C.s. cottoni, arr. 1950). Douliez 1979. Micha 1958: 111 (arr. 1950).
Berlin West: Klös 1963 (pair arr. 1963), 1969b: 246 (arr. 1963).
Boras: Berggren 1967 (in 1966).
Chicago: Reynolds 1962c (arr. 1962).

- Cologne*: Windecker 1970: 30 (arr. 1969).
Copenhagen: Eriksen 1977: 33 (3 arr. 1971, birth 1974).
Dvur Kralove: Still 1970 (4 present). Vagner 1980 (births).
Hanover: Anon. 1971c, i (birth 1971). Dittrich 1971 (arr. 1970, birth 1971), 1972 (birth 1971).
Lisbon: Florio 1973: 211 (pair).
Mallorca: Ruhe 1970: 259 (arr. 1969).
Memphis: Reynolds 1965a (arr. 1964).
Milwaukee: Reynolds 1962c (arr. 1962).
Münster: Schaller & Pilaski 1979: 169.
New York: Reynolds 1962c (arr. 1962).
Oklahoma City: Reynolds 1964a (arr. 1963).
Philadelphia: Anon. 1974a (pair arr. 1974).
Phoenix: Reynolds 1964a (pair arr. 1963).
Pretoria: Anon. 1970i (birth 1970). Bigalke 1947 (arr. 1946), 1975 (arr. 1946, births 1967, 1969). Bigalke et al. 1950: 519 (arr. 1946). Cillić 1949. Foster 1960: 28 (arr. 1946). Potter 1947: 385 (arr. 1946). Schack 1947, 1950, 1958 (arr. 1946, 1949). L. Smith 1968 (arr. 1966, birth 1967), 1970 (birth 1969).
Rangoon: Gorgas 1971: 30 (pair arr. 1964).
Rotterdam: van Bommel 1963a (pair arr. 1963). van Doorn 1967 (pair).
San Antonio: Dolan 1972 (birth 1972). Roney 1972 (arr. 1970, 1971, birth 1972). Schmidt & Hartfiel 1976 (birth 1975).
San Diego: Anon. 1973j (3 births 1972), 1973k (birth 1973), 1976b (birth 1976). Dolan 1971 (20 arr. 1971), 1972 (4 C.s. cottoni, birth 1972). Dolan & Moran 1969: 61 (arr. 1962). Hill 1972 (birth 1972), 1973a (birth 1972), 1973b (birth 1973). Jones 1977: 27 (2 C.s. cottoni, 20 C.s. simum, 18 births). Rawlins 1979. Reynolds 1962c (arr. 1962). Seaton 1971 (20 arr. 1971). Strassburger 1976: 9 (3 births 1976).
San Francisco: Reynolds 1964a (pair arr. 1963).
Thoiry: Ruhe 1970: 253 (arr. 1968).
Tokyo: Sotani 1974.
Whipsnade: Anon. 1970h (possible arrival), 1973a (arr. 1973, birth 1973). Rawlins 1979.

THE BLACK RHINOCEROS, DICEROS BICORNIS

6.1 REVIEW

Goddard 1966-1970. Groves 1967b. Reynolds 1963a. Ritchie 1963. Schenkel & Schenkel 1969b. Sidney 1965. Zukowsky 1965.

6.2 TAXONOMY AND NOMENCLATURE

6.2.1 *Revisions*

Brandt 1878a: 55 [see 1878b, c, 1879] (*Atelodus bicornis* with 3 varieties: *plasioceros*, with horn conical, bases touching, posterior horn 2/3 or 1/2 shorter than anterior; *porrhoceros*, with horn bases segregated, conical, posterior shorter than anterior; *platyceros*, with horns of equal size). Groves 1967b (*Diceros bicornis bicornis*, South Africa, Namibia; *D. b. chobiensis*, Angola; *D. b. minor*, East and S.E. Africa; *D. b. michaeli*, E. Africa; *D. b. brucii*, Somalia; *D. b. ladoensis*, Lado; *D. b. longipes*, Chad; some clines). Hopwood 1938, 1939 (*D. b. bicornis*, *D. b. holmwoodi*, *D. b. somaliensis*, unnamed Angolan and Nigerian races). Zukowsky 1965 [not 1964] (*Diceros bicornis bicornis*, S. Africa; *D. b. keitloa*, S.E. Africa; *D. b. keitloa* var. *minor*, S.E. Africa; *D. b. niger*, Namibia; *D. b. occidentalis*, Kaokofeld; *D. b. angolensis*, Angola; *D. b. chobiensis*, Chobe; *D. b. nyasae*, Nyasaland; *D. b. holmwoodi*, E. Africa; *D. b. rowumae*, S.W. Tanzania; *D. b. michaeli*, S. Kenya; N. Tanzania; *D. b. rendilis*, N. Kenya; *D. b. ladoensis*, Lado, Sudan; *D. b. somaliensis*, Somalia; *D. b. brucii*, E. Sudan; *D. b. atbarensis*, N.E. Sudan; *D. b. longipes*, W. Africa; unnamed form in Rhodesia and Zambia; key to subspecies).

6.2.2 *Remarks*

Allen 1939: 556 (*D. b. bicornis* and *D. b. somaliensis*). Ansell 1967: 6 (follows Hopwood 1939), 1978: 50 (*D. b. minor* in Zambia, possibly intergrading with *D. b. chobiensis*). Baker 1890: 89 (shape and length of horn not a good taxonomic character). Blancou 1954, 1958a (possible forest rhino in N.E. Zaire). Borcherds 1979: 219-220 (2 varieties in Cape province). Brooks 1876: 110 (distinguished black rhinos 'with unequal horns' and 'with equal horns'). Dollman 1921: 82 (*D. b. bicornis* and *D. b. somaliensis*). Duncan 1892: 325 (*R. bicornis* major, *R. b. minor* and *R. keitloa*). Gordon-Cumming 1850, 1: 249 (S. Africa, 2 varieties). Grout 1863: 295 (Zululand, 2 kinds - umkombe and ubejani - distinguished by size and temperament). Heinz 1933: 270, 275 (Namibia, skull possibly 'Diceros'). von Heuglin 1877, 11: 93 (Abyssinia, *R. bicornis*). von Höhnel 1892: 542, 612 (E. Sudan and Somaliland, a third species besides *R. bicornis* and *R. simus*). Home 1823, pl. 69 fig. 3 (Campbell's rhinoceros differs from others). Joubert 1970 (populations of N. Namibia and Natal cannot be separated, both are *D. b. bicornis*). Lönnberg 1912a: 121-122 ('no pronounced racial difference between the rhinos at Guaso

Nyiro and those in East and South Africa'). Loose 1975: 11 (recognition of subspecies presently impossible). Maydon 1932: 252 (Kenya folk tale, a forest and a bush type). des Murs et al. 1850: 26 (many species according to number of horns). Neumann 1898: 122 (one species in Africa), 276, 283 (animals near Lake Rudolf smaller than others). Neumann 1900: 556 (E. Africa, one variety). Peters 1852: 179 (Mozambique, not distinct from other black rhinos; Camper's figure between *R. bicornis* and *R. keitloa*). de Pousargues 1897: 137-138 (recognised *R. bicornis*, S. and E. Africa; *R. holmwoodi*, Tanzania). Roth 1969: 17 (rivers are natural barriers). Schomber 1963: 32 (Sudan and N. Ethiopia, specimens differ from smaller *D.b. somaliensis*, possibly a separate subspecies). von Schreber 1835: 342 (doubtful species; Gordon's and Bruce's rhinos). Schultze 1913: 126 (Kanuri tribe of Nigeria know large species 'kargadan' and small species 'kumarima'). Schwarz 1920 (no distinction of subspecies). Stockley 1948: 75 (Kenya, appearance differs in some localities). Tjader 1911: 311 (Kenya, difference between rhino of plains and of bush in horn form and size of feet). von Wissmann 1901: 45 (Tanzania, plains and bush forms). Zukowsky 1965: 79-86 (specimens from North and South Rhodesia not assigned to subspecies).

6.2.3 *Subspecies and synonyms of Diceros bicornis*

Rhinoceros africanus Blumenbach, 1797: 126.

Type-specimen: not designated. Blumenbach (1797: 126) refers to Blumenbach (1796, pl. 7 fig. A) depicting the skull first figured and described by Camper (1780, 1782).

Type-locality: Cape of Good Hope.

Authorship: Camper (1780) mentioned '*Rhinoceros africanus*' but this is a description rather than a name in the Linnean binomial system. Geoffroy & Cuvier (1795a: 326) mentioned Camper's '*Rhinoceros africanus cornu gemino*', which appears in the title of Camper (1780) and it is a reference to that paper. The name is often attributed to Desmarest (1822) who used it describing a complete skeleton and skin in the Paris Muséum no. A. 7. 969 collected by Delalande at the Cape of Good Hope (see Allen 1939: 557, Schwarz 1920).

Taxon considered valid:

Rhinoceros africanus Blumenbach 1797. - Alexander 1838. Blyth 1862a, 1863b. Boitard 1842. Cuvier 1816, 1829, 1836a. Desmarest 1822. Dugmore 1910. Duvernoy 1854. Fischer 1814. Fresnel 1848. Gloger 1841. Griffith 1827. Harris 1838, 1839, 1840. von Heuglin 1861, 1869. van der Hoeven 1855. Holl 1900. Horsfield 1851. Jardine 1836. Kaup 1833. Khalil 1927. Kirk 1864. Lesson 1827, 1838. Noack 1891. Oswell 1847. Peters 1852, 1871. Schinz 1824. von Schreber 1835. W. Selater 1891. Smith 1833, 1837, 1838. Smuts 1832.

Rhinoceros (*Atelodus*) *africanus*; Zittel 1891.

Opsiceros africanus; Gloger 1841.

Diceros bicornis angolensis Zukowsky, 1965: 73.

Type-specimen: Museum Göteborg, no. 7594, skull of adult male collected by S. Sjölander on 11 November 1948.

Type-locality: Virui-waterhole in Mossamedes dt., South Angola.

Taxon considered valid:

Diceros bicornis angolensis Zukowsky 1965.

Diceros bicornis atbarensis Zukowsky, 1965: 141.

Type-specimen: British Museum (Natural History), no. 69.10.24.48, collected by W.T. Blanford.

Type-locality: Anseba valley, Erythraea.

Taxon considered valid:

Diceros bicornis atbarensis Zukowsky 1965.

Rhinoceros bicornis Linnaeus, 1758: 56 referring to Kolb (1719), Jacobaeus (1696) and Schroeckius (1686).

Type-specimen: Linnaeus 1758: 56 ('cranium tantum...nobis visum': is indeterminate). Hopwood 1939: 453 (lectotype: the animal described by Kolb 1719). Zukowsky 1965: 32 ('holotype': Rijksmuseum van Natuurlijke Historie, Leiden, cat. a, skull collected at the Cape by Boie and Macklot, donated 3 June 1826 - see Mertens 1966, this 'holotype' is a neotype).

Type-locality: 'India' (Linnaeus 1758). Thomas 1911: 144 (restricted to Cape of Good Hope) - accepted by Allen 1939: 556, Ellerman 1954: 79, Groves 1967b: 271, Hill & Carter 1941: 148, Joubert 1970: 27, Lydekker 1916: 54, Schwarz 1920. Remarks on Linnaeus: Hopwood 1939: 452. Rookmaaker 1981: 114. Thomas 1911: 144. Zukowsky 1965: 11-13.

Remarks: Ansell 1960a (nominate race in Zambia), 1967: 6 (this subspecies from Cape north to Zambesi River). Darling 1960: 150 (*D.b. bicornis* in Zambia). Gmelin 1789: 57 (*R. bicornis*, habitat in Asia). Grimwood et al. 1958: 467 (nominate race in Zambia). Joubert 1970 (*D.b. bicornis* in Natal and N. Namibia). Rookmaaker & Groves 1978 (new description of the subspecies and review of literature). Sweeney 1959: 57 (*D.b. bicornis* in Zambia).

Taxon considered valid:

Atelodus bicornis; Pomel 1853. - Brandt 1878a, b, c, 1879. Breuning 1924. Flower 1876, 1891. Steinmann & Döderlein 1890.

Biceros bicornis; Virchow 1910.

Ceratotherium bicornis; Hiley 1977 error for *C. simum*.

Diceros bicornis; Thomas 1901. - (Note: This combination was generally used after 1950.) - Babault 1949. Blancou 1933, 1935a. Chubb 1909. Frechkop 1936. Haagner 1920. Heinz 1933. Hindle 1947b. Hooijer 1946b. Jeannin 1936, 1945. Kuiper & Schneider 1940. Lavauden 1934. Malbrant 1936. Meinertzhagen 1938. Priemel 1930. Schwarz 1920. Schneider 1930. Thomas 1929. Zeuner 1934. Zwilling 1940.

Diceros bicornis bicornis; Shortridge 1934 - Allen 1939. Ansell 1960a, 1967. Bere 1958. Blyth & Harthoorn 1965. Ellerman et al. 1953. Groves 1967b. Guérin 1980. Guggisberg 1966a. Hall-Martin & Penzhorn 1977. Harper 1945. Heinichen 1970. Hitchens 1971, 1978. Hopwood 1939. Joubert 1970. King 1969. Krumbiegel 1960. Lancaster 1953. Mackenzie 1954. Moreau 1944. Pienaar 1963. Potter 1947. Ripley 1958. Ritchie 1963. Roberts 1951. Rookmaaker & Groves 1978. Roosevelt & Heller 1915. Sauer 1972. Schouteden 1945. Shortridge 1942. Smithers 1968, 1971. Swynnerton & Hayman 1951. Watson 1949. Zukowsky 1949, 1965.

Rhinaster bicornis; Gray 1862, 1868, 1869a, b. Jentink 1887, 1892.

Rhinoceros africanus bicornis; Delegorgue 1847. - Keller 1909.

Rhinoceros bicornis Linnaeus 1758. - (Note: This combination generally used before 1900 except when *R. africanus*.) - Alexander 1907. Augiéras 1935. Blancou 1932. Brocklehurst 1931. Broun 1905. Cox 1900. Davies 1953.

- Dickinson 1907. Drake-Brockman 1910. Fitzsimons 1920. S. Flower 1931. Foa 1908. Gleichen 1905. Gijzen 1960. Hobley 1926. Jacobi 1957a. Killermann 1910. Knottnerus-Meijer 1905. Letscher 1911. Lönnberg 1912a. Lyell 1910. 1912. 1913. Malbrant 1930. Matschie 1918. Mitchell 1911b. 1923. 1928. Murray 1932. Neumann 1900. Neveu-Lemaire 1924a, b, 1925a, b. Osborn 1900. Pease 1908. Pecaud 1925. Peel 1900. Player 1972. Renshaw 1904. Rodhain & Bequaert 1918. Sayers 1930. Schouteden 1913. Schubotz 1912. Schultze 1913. W. Selater 1900. Siedler 1905. Statham 1922. Thomas 1911. Weber 1904. Wroughton 1907. Zammarano 1924.
- Rhinoceros (*Atelodus*) *bicornis*; Woodward 1898.
- Rhinoceros (*Diceros*) *bicornis*; Schouteden 1911. de Beaux 1923. Foenander 1952. Friant 1950.
- Rhinoceros (*Diceros*) *bicornis bicornis*; Lydekker 1916. Dollman 1921. Monard 1935.
- Rhinoceros *unicornis bicornis*; Linnaeus 1766.
- Rhinoceros brucei* Lesson, 1842: 159 (as: '*Rhinoceros bicornis* var. *A. Rhinoceros Brucei*, Blainv.'). The reference is to de Blainville (1817: 168, 1819) who described the 'rhinocéros de Bruce' after Bruce (1790).
- Type-specimen: undesignated. Zukowsky 1965: 132 (neotype Museum Berlin, no. 21392, coll. Binder - see Mertens 1966).
- Type-locality: Tscharkin, between Bahr Salaam and Atbara, near Ras el Feel, Ethiopia (Schwarz 1920: 870. Zukowsky 1965: 132).
- Remarks: Ansell 1967: 6 (nomen nudum). Blanford 1870: 243 (Bruce's figure is *R. unicornis* with additional horn). Blyth 1862a: 153 (*R. unicornis* with additional horn). Brehm 1877: 518 (synonym of *bicornis*). Hollister 1924: 135 (nomen nudum). Lesson 1838: 514 (mentions Bruce's rhinoceros).
- Bruce's plate: Blumenbach 1791: 283 (from Buffon, with second horn). Bruce 1790, pl. facing p. 85 (rhinoceros of Africa). Desmarest 1822: pl. 41 fig. 2. Gombrich 1962: 70, fig. 59 (species unknown). Gowers 1952: 289 (from Buffon). Matschie 1918: 103 (from Buffon, with second horn). Strack 1819, pl. 76.
- Taxon considered valid:
- Diceros bicornis brucei*; Zukowsky 1949.
- Diceros bicornis brucei*; Zukowsky 1965. - Groves 1967b. Guérin 1980. Schlawe 1969.
- Rhinoceros brucei* Lesson 1842. - Chenu & Desmarest 1858.
- Rhinoceros camperi* Schinz, 1845: 335.
- Type-specimen: undesignated. Rookmaaker & Groves 1978: 125 (specimen described by Camper (1780, 1782) formerly in Groningen museum).
- Type-locality: Cape of Good Hope (Groves 1967b: 273. Schwarz 1920: 871. Zukowsky 1965: 33).
- Remark: Brehm 1877: 518 (synonym of *bicornis*). Gray 1868: 1025 (var. 2 *camperi* of *Rhinaster keitloa*).
- Taxon considered valid:
- Rhinoceros camperi* Schinz 1845.
- Rhinaster keitloa* var. *camperi*; Gray 1868, 1869b.
- Rhinoceros bicornis capensis* Gray 1868: 1025 (in list of synonyms), referring to Camper (1780) but the name does not appear there.

Type-specimen: not designated.

Type-locality: South Africa.

Authorship: the name was often attributed to Trouessart 1898: 757, see Allen 1939: 557, Groves 1967b: 273. Joubert 1970: 27. Brandt (1878a: 55) mentioned '*Rhinoceros bicornis capensis* P. Camper', *capensis* not italicized, which cannot be taken as a use of *R. b. capensis*.

Diceros bicornis chobiensis Zukowsky, 1965: 79.

Type-specimen: Museum Berlin no. 35745, coll. H. Mattenklodt.

Type-locality: Konsumbia, tributary of river Loma.

Taxon considered valid:

Diceros bicornis chobiensis Zukowsky 1965. - Groves 1967b. Guérin 1980.

Rhinoceros cucullatus J.A. Wagner in von Schreber 1835: 317-323.

Type-specimen: formerly in Zoologische Staatssammlung, Munich, destroyed in second world war (Zukowsky 1965: 134).

Type-locality: Ethiopia. Schwarz 1920: 871 ('Schoa?').

Remarks: Allen 1939: 567 (status uncertain, listed as synonym of *D. b. somaliensis*). Blumenbach 1791: 283-284, pl. 45 (specimen in Mannheim museum is *R. unicornis* with two horns). Blyth 1863b (synonym of *R. sumatrensis*). Brandt 1878a: 45-48 (review. Asian species). Brehm 1877: 519 (synonym of *R. simus*). Gray 1868: 366 (*R. unicornis* with second horn). Hartmann 1868: 366 (from Ethiopia, status uncertain). von Heuglin 1877, II: 95 (status unsolved). Hopwood 1939: 453 (artefact). Lydekker 1916: 55 (in Abyssinia). Murray 1866: 338 (valid species in S. Ethiopia). Schillings 1925, pl. facing p. 104 (rhino in Tanzania as '*Ceratorhinus aff. cucullatus* Wagn.'). Schinz 1845: 337 (valid species described; '*hospitatur in museo Monacensi*'). Schwarz 1920: 871 (synonym of *D. bicornis*, possibly artefact). Wagner 1850 (specimen in Zoologische Staatssammlung, Munich; first plate in Blumenbach 1791). Zukowsky 1965: 133-136 (artefact; review).

Taxon considered valid:

Ceratorhinus cucullatus; Brandt 1878a, b, c, 1879.

Ceratorhinus aff. cucullatus; Schillings 1925.

Rhinoceros cucullatus von Schreber 1835. - Chenu & Desmarest 1858. Giebel 1855. Lydekker 1883. Murray 1866. Noll 1873. Schinz 1845. Schlegel 1857. Wagner 1850.

Rhinoceros (Ceratorhinus) cucullatus; Zittel 1891.

Rhinoceros (Diceros) bicornis cucullatus; Lydekker 1916.

Rhinoceros gordonii Lesson, 1842: 159 (as: '*Rhinoceros bicornis* var. *B. Rhinoceros Gordonii*, (Blainv.)).

Type-specimen: not designated, but ultimately the specimens described and figured by Gordon in Allamand 1781 (Cave & Rookmaaker 1977).

Type-locality: South Africa (Schwarz 1920: 870).

Note: Lesson referred to de Blainville (1817: 168, 169) who described a '*Rhinocéros de Gordon*', also found in Desmarest (1822). Robert Jacob Gordon saw the rhinoceros in the western Cape province. His notes and drawings were first published by Allamand (1781) where the animal is said to have 7 cheek teeth in each half of both jaws, 28 in all (p. 11). This article was reprinted the next year in Paris (Allamand 1782) where the number of teeth is curiously 'corrected'.

possibly by Buffon, without any notice, into: 'il a vingt-huit dents en tout; savoir six molaires à chaque côté des deux mâchoires, & deux incisives en haut & en bas' (p. 81). This has raised misunderstanding (Cuvier 1812b: 16, Lesson 1827: 332) and possibly led to the recognition of this taxon (see Cave & Rookmaaker 1977: 151). Gordon's contribution to zoology is discussed by L.C. Rookmaaker, 'De bijdrage van Robert Jacob Gordon (1753-1795) tot de kennis van de Kaapse fauna', *Documentatieblad Werkgroep 18e-eeuw*, 46 (1980): 3-27; and his, 'De Gordon Atlas: achttiende-eeuwse voorstellingen van het Zuidafrikaanse binnenland', *Bulletin Rijksmuseum*, Amsterdam, 29 (1981): 123-135.

Remarks: Cave & Rookmaaker 1977: 150 (synonym of *D.b. bicornis*). Chenu & Desmarest 1858: 10. Desmarest 1819: 245 (rhinocéros de Gordon is possibly *R. simus*). Ellerman et al. 1953: 163 (nomen nudum). Gray 1868: 1027 (synonym of *C. simum*). Joubert 1970: 27 (nomen nudum). Lesson 1838: 514 (rhinocéros de Gordon is possibly *R. simus*).

Taxon considered valid:
Rhinoceros gordonii Lesson 1842. - Chenu & Desmarest 1858.

Rhinoceros bicornis holmwoodi: Slater, 1893. Proposed provisionally.
 Type-specimen: two horns donated by Frederick Hopwood obtained in Zanzibar, in collection of British Museum (Natural History). Hopwood 1939: 454 (lectotype: the straight horn figured by Slater 1893, fig. 1, now BMNH, no. 94.3.3.1).

Type-locality: probably 'country of 'Udalia', situated at the N.E. point of Usukuma, 50 miles south of Speke gulf' (Slater 1893). Tanzania.

Remarks: Ansell 1967: 6 (north of Zambesi to Guaso Nyiro). 1969: 176 (synonym of *D.b. minor*). Bryden 1899: 67 (remarkable horns obtained from ordinary black rhinoceros). Gregory 1896: 266 (name used for 'white' rhinoceros in Kenya). Hollister 1924: 135 (East Africa). Neumann 1898: 34 (not valid). de Pousargues 1897: 137 (Tanzania). Roosevelt & Heller 1915, 11: 652 (not valid). Schouteden 1945: 264 (Zaire). Watson 1949: 185 (not valid). Wickenburg 1899: 410 (East Africa).

Taxon considered valid:
Diceros bicornis holmwoodi: Hollister 1924. - Ansell 1967. Hopwood 1939. Schouteden 1945. Zukowsky 1965.
Rhinoceros homewoodi: Elliot 1896 (lapsus).
Rhinoceros holmwoodi: Gregory 1896. - de Pousargues 1897. Swynnerton 1945.
Rhinoceros bicornis holmwoodi: Slater 1893.
Rhinoceros (Dicera) bicornis holmwoodi: Berger 1910b.
Rhinoceros (Diceros) bicornis holmwoodi: Lydekker 1916.

Rhinoceros keitloa Smith, 1836: 44.
 Type-specimen: not designated. Hopwood 1939: 454, pl. 10 fig. 2 (holotype is specimen brought to England by Smith (1837), bought by British Museum in 1838, no. 38.6.9.101 - see Zukowsky 1965: 41).

Type-locality: 'country north and south of Kurriehaine' (Smith 1836) in N. Transvaal. Smith 1837: 7 (restricted to 'about 180 miles N.E. of Lattakoo' where type-specimen was shot).

Remarks: Blanford 1870: 243, 246 (Abyssinia). Brehm 1877: 518 (synonym of *bicornis*). Giebel 1855 (Spielart). Gray 1868: 1025 (*Rhinaster Keitloa* with 2 varieties: *Keitloa* and *camperi*). Groves 1967b: 272 (maybe synonym of *D.b. bicornis*). 274 (*Rhinoceros keitloa* Blanford 1870: 243 'not of A Smith, 1836'

synonym of *D.b. brucei*). Hartmann 1868: 365 (sexual variety of *bicornis*). Hopwood 1939: 454 (individual variation). Oswell 1847 (synonym of *R. africanus*). Peters 1852: 179. Roosevelt & Heller 1915, 11: 652 (not valid). Slater 1870: 324 (distinction uncertain). W. Slater 1900: 306 (accidental variety). Selous 1881 (*keitloa* not different from *bicornis*). Wahlberg 1845: 427 (not a good subspecies, possibly sexually determined).

Taxon considered valid:
Diceros bicornis keitloa: Zukowsky 1949, 1965.
Rhinaster keitloa: Gray 1868, 1869a, b, c.
Rhinaster keitloa, var. *camperi*: Gray 1868, 1869b.
Rhinaster keitloa, var. *keitloa*: Gray 1868, 1869b.
Rhinoceros keitloa Smith 1836. - Andersson 1856. Blanford 1868, 1870. Buckley 1876. Drummond 1875, 1876. Duncan 1892. Falconer 1868. Hartmann 1868. von Heuglin 1877. Kirby 1899. Murray 1866. Noll 1873. Pöppig 1851. Schinz 1845. Schlegel 1857, 1872. Slater 1870. Selous 1876. Smith 1838. Wood 1851.
Rhinoceros keitloa: [Blyth, 1870a.]

Rhinoceros ketloa Smith, 1837: 7 (lapsus for *R. keitloa*).

Taxon considered valid:
Atelodus ketloa: Pomel 1853.
Rhinaster ketloa: Gray 1862.
Rhinoceros ketloa Smith 1837. - Chenu & Desmarest 1858. Gray 1843. Layard 1861.

Rhinoceros kulumane Player, 1972: 25. Published without description but attributed to Drummond, who (1875: 84) distinguished a species locally known as *kulumane* in Umfolozi park, but which 'has not yet received a scientific name.' Later, Drummond (1876: 109) described his *Rhinoceros bicornis major*, 'the greater black species, known as the *kulumane* on the eastern side...'

Diceros bicornis ladoensis Zukowsky, 1965: 124. Proposed conditionally.
 Type-specimen: Museum Munich, no. 1912/4201, coll. Hesselberg 3 Feb. 1912.
 Type-locality: Shambe in Lado dt.
 Remark: Mertens 1966 (proposed by implication, hence invalid).
 Taxon considered valid:
Diceros bicornis ladoensis Zukowsky 1965. - Groves 1967b. Guérin 1980.

Diceros bicornis longipes Zukowsky, 1949.
 Type-specimen: Senckenberg museum, Frankfurt am Main, no. 766 (839) A.54, adult female, coll. Herzog Adolf Friedrich zu Mecklenburg.
 Type-locality: Mogrum, S.W. Chad.
 Taxon considered valid:
Diceros bicornis longipes Zukowsky 1949. - Groves 1967b. Guérin 1980. Zukowsky 1965.

Rhinoceros bicornis major Drummond, 1876: 109.
 Type-specimen: not designated.
 Type-locality: South Africa.
 Remark: Zukowsky 1965: 48 (synonym of *D.b. keitloa*).

Taxon considered valid:

- Rhinoceros bicornis major* Drummond 1876. – Duncan 1892. Selous 1876.
- Diceros bicornis michaeli* Zukowsky, 1965: 115.
Type-specimen: Museum Berlin, no. 46166, skull collected by W. Zietl.
Type-locality: between Engaruka and Serengeti, N. Tanzania.
Taxon considered valid:
 Diceros bicornis michaeli Zukowsky 1965. – Groves 1967b. Guérin 1980. Hall-Martin & Penzhorn 1977.
- Rhinoceros bicornis minor* Drummond, 1876: 109.
Type-specimen: not designated.
Type-locality: South Africa, all country south-east of Zambesi river. Zukowsky 1965: 48 (Zululand selected).
Remarks: Ansell 1969: 176 (this subspecies in Zambia, is *D.b. holmwoodi*). Groves 1967b: 273 (East and S.E. Africa). Zukowsky 1965: 48 (variety of *D.b. keitloa*).
Taxon considered valid:
 Diceros bicornis keitloa var. *minor*; Zukowsky 1965.
 Diceros bicornis minor; Groves 1967b. – Ansell 1969, 1978. Guérin 1980. de Vos 1980. de Vos & Braack 1980.
 Rhinoceros bicornis minor Drummond 1876. – Duncan 1892.
- Rhinoceros niger* Schinz, 1845: 335, referring to Alexander 1838.
Type-specimen: not designated.
Type-locality: 'Africa meridionalis partibus interioribus' (Schinz 1845). Schwarz 1920: 871 (restricted to Chuntop near Mt. Mitchell, Kuiseb mountains, Namibia).
Remark: Brehm 1877: 518 (synonym of *bicornis*).
Taxon considered valid:
 Diceros bicornis niger; Zukowsky 1949, 1965.
 Rhinoceros niger Schinz 1845.
- Diceros bicornis nyasae* Zukowsky, 1965: 93. Proposed conditionally.
Type-specimen: not designated.
Type-locality: around Lake Nyassa.
Remark: Mertens 1966 (proposed by implication, hence invalid).
Taxon considered valid:
 Diceros bicornis nyasae Zukowsky 1965.
- Opsiceros occidentalis* Zukowsky, 1922.
Type-specimen: Museum Hamburg, no. 40056, young male, lived in Hagenbeck's Tierpark, Hamburg, 10 July 1914 – 15 October 1916.
Type-locality: Kaokofeld-Kunene region, S.W. Africa.
Remarks: Shortridge 1934: 412, 423 (S.W. Africa, synonym of *R. niger* if distinguishable from typical race). Zukowsky 1950: 216, 1954-56.
Taxon considered valid:
 Diceros bicornis occidentalis Shortridge 1934. – Guggisberg 1966a. Zukowsky 1949, 1950, 1954-56, 1965.
 Opsiceros occidentalis Zukowsky 1922. – Wilhelm 1933, 1950. Zukowsky 1924.
- Diceros bicornis palustris* Benzon, 1947.
Type-specimen: not designated.

- Type-locality: Bahr el Ghazal, S.W. Sudan.
Remarks: Ansell 1967: 6 (possibly synonym of *D.b. somaliensis*). Groves 1967b: 274 (synonym of *D.b. brucii*).
Taxon considered valid:
 Diceros bicornis palustris Benzon 1947.
- Diceros bicornis punyana* Potter, 1947.
Type-specimen: not designated.
Type-locality: Hluhluwe, Zululand.
Remarks: Potter 1947 (a smaller, bad tempered variety called 'punyani' occurring besides the ordinary 'ubejani'). Zukowsky 1965: 48 (synonym of *D.b. keitloa* var. *minor*).
Taxon considered valid:
 Diceros bicornis punyana Potter 1947.
- Diceros bicornis rendilis* Zukowsky, 1965: 122.
Type-specimen: Naturhist. Museum Stockholm, skull of 56, 5 cm length, collected by E. Lönnberg.
Type-locality: northern Guaso Nyiro, Kenya.
Taxon considered valid:
 Diceros bicornis rendilis Zukowsky 1965.
- Diceros bicornis rowumae* Zukowsky, 1965: 94. Proposed conditionally.
Type-specimen: Museum Berlin, no. 14828 (5000 LH), coll. Rolle.
Type-locality: interior of Mikindani on river Rowuma, Tanzania.
Remarks: Mertens 1966 (proposed by implication, hence invalid).
Taxon considered valid:
 Diceros bicornis rowumae Zukowsky 1965.
- Rhinoceros bicornis somaliensis* Potocki, 1897: 82, 102-104 (1900: 82-83), referring to rhinos shot by Swayne in 1892 'when it was recognised as a variety distinct from the central African form' but Swayne (1894, 1895) doesn't suggest that.
Type-specimen: not designated. Lydekker 1916: 55 (lectotype: figure in Potocki 1897, facing p. 104 – see Hopwood 1939: 455, specimen destroyed). Schwarz 1920: 870 (neotype: skull in British Museum (Natural History), no. 11.8.2.20, shot in Somaliland by R.E. Drake-Brockman – see Hopwood 1939: 455, pl. 11 fig. 2; Lydekker 1911b).
Type-locality: Somaliland.
Remarks: Ansell 1967: 6 (Abyssinia, Ethiopia). Hollister 1924 (northern Guaso Nyiro). Lydekker 1911b (comparison with E. African skull). Roosevelt & Heller 1915, 11: 650-658 (differences from *D.b. bicornis*). Setzer 1956: 570 (Jubaland). Schwarz 1920: 870 (name in Potocki is *nomen nudum*; author should be Lydekker 1911; subspecies not distinct).
Taxon considered valid:
 Diceros bicornis somaliensis; J. Allen 1914. – Allen 1939. Ansell 1967. Guggisberg 1966a. Haltenorth & Trense 1956. Harper 1945. Hollister 1924. Hopwood 1939. Krumbiegel 1960. Ritchie 1963. Roosevelt & Heller 1915. von Rosen 1953. Schomber 1963. Setzer 1956. Zukowsky 1949, 1965.
 Rhinoceros bicornis somaliensis Potocki 1897, 1900. – Lydekker 1911b.
 Rhinoceros (Diceros) bicornis somaliensis; Lydekker 1916. – de Beaux 1923. Dollman 1921.

6.2.4 *Lapsus in names*

- Diceros bicornis*, Joubert 1970: 27.
Rhinoceros brucei, Gray 1868: 1025 (in list of synonyms, attributed to de Blainville).
Diceros bicornis brucei, Zukowsky 1949.
Rhinoceros homewoodi, Elliot 1896: 247 ('white variety' in Karagwe).
Rhinoceros ketloa, Smith 1837: 7 (see above).
Rhinoceros simus, Stockley 1948: 25 (for this species).

6.2.5 *Lists of synonyms*

- Allen 1939: 556-557. Ansell 1967: 6. Ellerman et al. 1953: 163. Groves 1967b.
 Groves & Rookmaaker 1978: 125. Joubert 1970: 27. Lydekker 1916: 52-54.
 Murray 1866: 338. Schwarz 1920: 870-871.

6.2.6 *One-horned rhinoceros in Africa*

- Blyth 1862a: 153, 1862d (information of Bruce, Smith, Livingstone). Brandt 1878a: 39-40, 56 (review). Carbou 1912: 66 (Tchad, absence of one-horned rhino). Fresnel 1848 (Sudan, one-horned rhino). Livingstone 1854: 300 (Zambia, animal with one horn). Smith 1837: 8 (inland, species with one horn). A.H. Smith 1968: 104-108 (Cape, various accounts of 'unicorn').

6.3 NAMES IN VERNACULAR

- General*: Best & Raw 1975: 164. Fitzsimons 1920: 213. Kingdon 1979: 92. Lyell 1913: 163 (Chinyanja, Chingoni). Matschie 1895: 97. Rode 1944: 161 (Sara, Banda, Kotoko, Baguirmien).
Angola: du Bocage 1890: 23. Monard 1935: 257. Statham 1922: 254.
Ethiopia: Bruce 1790: 90. Hartmann 1868: 363. des Murs et al. 1850: 26. von Rosen 1953: 38.
Kenya: Bennet 1914: 184. Berger 1910b: 361. Noack 1887: 195. Roosevelt & Heller 1915, II: 651. Stigand 1909: 280.
Mozambique: Kirk 1864: 655. Peters 1852: 179.
Namibia: Barnard 1952. Drummond 1875.
Nyasaland: Lyell 1912: 34.
Rhodesia: Chubb 1909: 124.
Somalia: Drake-Brockman 1910: 106. Funaioli & Simonetta 1966: 296. Ghika 1898: 177. von Heuglin 1861: 15. Maydon 1932: 235. Roosevelt & Heller 1915, II: 656. Swayne 1894: 321.
South Africa: Allamand 1781 (Hottentots). Bryden 1893: 489, 1899: 35. Drummond 1875: 84. Burchell 1836: 4. Gaerdes 1966: 231 (Herero). Harris 1839: 371. Nicolls & Eglinton 1892: 62. Oswell & Vardon 1847: 183 (Bechuanas). Roberts 1951: 242. W. Selater 1900: 304. Smith 1940, II: 204 (Baquans).
Sudan: Barth 1857: 278. Brocklehurst 1931: 111. Maydon 1932: 139.
Tanzania: Roosevelt & Heller 1915, II: 651.
Uganda: Watson 1949: 183.
West Africa: Blancou 1933: 19. Bourgoin 1955: 63. Carbou 1912: 66. Denham & Clapperton 1826: 194 (Chad). Jeannin 1930: 165 (Cameroon), 1945: 105. Zwilling 1940: 368.
Zaire: Foa 1908: 405. Frechkop 1936: 14.
Zambia: Ansell 1960a: 52. Sweeney 1959: 57. Wroughton 1907: 32.

6.4 EXTERNAL MORPHOLOGY

6.4.1 *Appearance*

- Alexander 1838, II: 1. Allamand 1781, 1782, 1785. Andersson 1856: 388. Barrington 1803: 255. Barrow 1804, II: 125. de Beaux 1912: 562. Best & Raw 1975: 164. Boitard 1842: 405. Borchers 1979: 219. Brehm 1877: 517. Brink 1778: 37. Burchell 1824, II: 74. Burton 1962: 209. Camper 1780, 1782: 146-158, 162-171. Cave 1947, fig. 1, pl. 5. Chenu & Desmarest 1858: 9. Crandall 1968: 507. Cuvier 1829: 247. Dekeyser 1955: 313. Delegorgue 1847: 424. Desmarest 1819: 244. Dorst & Dandelot 1970: 166. Duncan 1892: 325. Faujas-St. Fond 1809: 197-199, pls. 9, 10. Fitzsimons 1920: pl. facing p. 213. Foa 1908: 405-410. Frechkop 1936: 14. Gatti 1965: 79. Gordon-Cumming 1850, I: 249-251. Groves 1967b: 270 (habitus-types). Guérin 1980: 29. Guggisberg 1966a: 33-35. Haltenorth et al. 1979: 104. Harris 1838: 376. von Heuglin 1877, II: 93. Heymans & Colyn 1981: 158. Jeannin 1936: 32. Lesson 1838: 513. Levaillant 1795, III: 57. Lydekker 1892b. Malbrant 1936: 22. Owen 1956: 27. Ritchie 1963: 55. Roberts 1951: 569. Rode 1944: 161. Rookmaaker & Groves 1978: 122. Schinz 1824. von Schreber 1835: 337. Schwarz 1920: 869. Selater 1870: 323, 1886a. Selous n.d.: 187. Shaw 1800: 202. Smith 1833: 179, 1838, 1940, II: 57. Somerville 1979: 162. Sparrman 1778, (1787) 1977: 80-84, 89-92. Strack 1819, pl. 76. Thunberg 1811: 320. Zammarrano 1930: 166. Zeuner 1934: 34 (position of head). Zukowsky 1922, 1965.

6.4.2 *Colour*

- Baines 1864: 395. Drummond 1875. Fitzsimons 1920: 219. von Götzen 1895: 143. Haagner 1920: 126. von Heuglin 1869: 301. Neumann in Bryden 1899: 45. Noack 1889: 107. Potter 1949: 128 (at birth). Roosevelt & Heller 1915, II: 653. Smith 1838.

6.4.3 *Absence of Ear conch*

- Gewalt 1965. Goddard 1969b. Grzimek 1966. Guggisberg 1966a: 21. hb. 1970. Spinage 1960: 97. de Vos & Braack 1980 (unilateral carless male).

6.4.4 *Foetus*

- Andersson 1856: 392 (size). Brauer 1910. Davies 1952. Toldt 1914. Wilson & Edwards 1965: 180 (size).

6.4.5 *Footprints*

- Peel 1900: 276 (size). Pocock 1912.

6.4.6 *Hair*

- de Beaux 1912: 562. van den Bergh 1970 (eyelashes). Cave 1969 (body hair, eyelashes, absence of facial vibrissae). Groves 1967a: 222. Kubiak & Dziurdzik 1973 (histology). Miller 1967. Roosevelt & Heller 1915, II: 653.

6.4.7 *Horn*

- Anon. 1978c (artificial third horn). Baker 1890: 90. Bigalke 1946 (loss and growth). Blyth 1870a (bifid horns). Brocklehurst 1931: 111 (additional horns). Brouard 1978 (artificial horn, Lisbon zoo). Broun 1905: 297. Chapman 1908: 141 (extra horn). Flower 1889 (extra horn). Gewalt 1965. Gray 1869b: 397. Groves 1971 (review). Guggisberg 1966a: 21, 36, 37. Home 1821: 272. Jacobi 1957a (sawing off and growth). Lubach 1868 (extra horn). Lydekker 1892b (extra horn). Lyell 1910: 52

(outgrowth behind 2nd horn). Nakagawa & Nishiyama 1959 (growth of broken horn). Natal Parks Board 1953: 21 (loss of horn). Parsons 1766. Ritchie 1963: 60 (structure). Roosevelt & Heller 1915, II: 652. Slater 1893 (unusual horns). Spinage 1960: 95 (unusual form). Stockley 1948: 25. Tjader 1911: 131, 132. van de Werken 1966b: 25 (hornless animal). Willoughby 1889: 155 ('Rhinoceros tricornis').

6.4.8 Horn measurements

Alexander 1907: 394. Baines 1864: 395. Baker 1872: 247, 1890: 95. de Beaux 1923: 287 (Somalia). Bennet 1914: 184, 186. Best & Raw 1975: 489-491 (records). Best et al. 1962: 258. Bigalke 1946. Blanford 1870: 245. Brocklehurst 1931: 111. Bryden 1899: 36. Chapman 1908: 141, 180, 244. Cooke 1950: 401. Falconer 1868, II: 402. Field 1958. Gaerdes 1966: 231. Gray 1869b: 397. Grout 1863: 295. Guggisberg 1966a: 37, 1966c: 40. Haltenorth & Trense 1956: 413. Hardy 1959. von Heuglin 1877, II: 93. Kirby 1899: 337. Letscher 1911: 120. Levaillant 1795, III: 54. Lönnberg 1912a: 121. Lydekker 1892b, 1907c: 73. Lyell 1910: 22, 1912: 34, 1913: 164. Maydon 1932: 144. des Murs et al. 1850: 26. Noack 1891: 79. Ritchie 1963: 60. Rode 1944: 162. Roosevelt & Heller 1915, II: 655, 658. von Rosen 1953: 38. Rosevear 1939: 107. Sauer 1972. Sayers 1930: 404. Schillings 1925: 110. Selous 1893: 456, 1907: 191, 199. Steinhardt 1920: 42. Swayne 1894: 322. Ward 1896: 285. van de Werken 1966b: 25. Willoughby 1889: 141, 143.

6.4.9 Size

Alexander 1838, II: 1. Allamand 1781: 13, 1785. J. Allen 1914: 340 (Somaliland). Baines 1864: 396. Baker 1872: 246. Blancou 1935b: 59 (Congo). Bennet 1914: 185. Blanford 1870: 249 (Abyssinia). Boitard 1842: 405. Bourgoin 1955: 63. Brink 1778: 37. Burchell 1824, II: 74. Burton 1962: 209. Camper 1782: 146-158, 162-171. Cave 1947, fig. 1, pl. 5. Cave & Rookmaaker 1977: 149, 150 (Cape). Chenu & Desmarest 1858: 9. Condy 1964: 32 (Rhodesia). Crandall 1968: 507. von der Decken 1869: 260 (Kenya). Dekeyser 1955: 313. Desmarest 1822. Dollman 1921: 82. Dorst & Dandelot 1970: 166. Drake-Brockman 1910: 106 (Somalia). Drummond 1875 (S. Africa). Faust 1964a: 30. Fitzsimons 1920: 219. Frädrieh & Frädrieh 1973: 190. Freeman & King 1969 (Kenya). Gaerdes 1966: 231. Giebel 1855: 200. Gordon Cumming 1850, I: 249. Guggisberg 1966a: 35 (Kenya). Haagner 1920: 126. Haltenorth et al. 1979: 104. Harris 1838: 376, 1839: 371. Heymans & Colyn 1981: 158. Hitchins 1968b. Jeannin 1936: 32, 1945: 105. Jobaert 1955: 52 (Zaire). Kingdon 1979: 92. Kirby in Bryden 1899: 36. Lenz 1835: 328. Leplae 1925: 47 (Zaire). Levaillant 1795, III: 54. Lydekker 1911b: 960 (Somalia, E. Africa). Lyell 1910: 22, 1912: 34, 1913: 163. Malbrant 1936: 25. Maydon 1932: 114. Meinertzhagen 1938: 434 (Kenya). Mentis 1970: 375. Neumann 1898: 196, 425 (Kenya). Neumann in Bryden 1899: 43. Peel 1900: 299 (Somaliland). Ritchie 1963: 55. Roberts 1951: 242. Rode 1944: 162. Rookmaaker & Groves 1978: 119, 123. Roosevelt & Heller 1915, II: 654, 658. Rosevear 1939: 107. von Schellendorf 1916: 9 (Tanzania). Schinz 1824: 290. Schneider 1930: 23 (E. Africa). von Schreber 1835: 334-337. W. Slater 1900: 305. Selous n.d.: 187, 1893: 456. Shortridge 1934: 424. Silberman & Fulton 1979: 7. Smith 1833: 179, 1838. Smuts 1832: 61. Somerville 1979: 163 (Cape). Sparrman 1778. Stockly 1948: 25, 1950: 88. Talbot & Talbot 1961 (weight). Tjader 1911: 131. Thunberg 1811: 320 (Cape). Ward 1896: 285. Watson 1949: 185. Wilhelm 1933: 55, 1950: 12 (Angola). Wilson & Edwards 1965 (Zambia). Zapparano 1924: 225, 1930: 166, 1932: 64, 88 (Somalia). Zukowsky 1965.

6.4.10 Size at birth and growth

Anon. 1964b, 1965b. Bean 1941. Burton 1962: 209. Dittrich 1965, 1967, 1972 (growth). Faust 1958: 214, 1964b: 275. Frädrieh & Frädrieh 1973: 190. Freiheit 1971. Goddard 1973: 58. Greed 1967. Hays 1967. Hediger 1955. Krag 1966: 87 (growth). McCrane 1967 (9 days). Reed 1969: 264 (growth). Rookmaaker 1973b.

6.4.11 Skin

Barrow 1804, II: 125 (impenetrable).

6.4.12 Age classes

Foster 1965 (7 groups according to dentition). Goddard 1970a (20 relative age classes based on dentition). Guérin 1980: 153-155 (comparison of subadult and adult skulls). Hitchins 1970 (immature animals), 1978 (according to tooth eruption and attrition). Roth & Child 1968: 220.

6.4.13 Individual recognition

Goddard 1966: 69. Hitchins 1969: 81. Mukinya 1976. Schenkel & Schenkel 1969b: 35.

6.4.14 Sexual dimorphism

Baker 1890: 105 (shape of horn). Foster 1965 (inability to sex skulls). Guérin 1980: 157, 158 (males larger than females). Harris 1838: 376 (size difference). Kirby in Bryden 1899: 36 (female's horn more slender and longer). Stockley 1950: 88 (possible sexual difference, Kenya).

6.5 ANATOMY

6.5.1 Review and general dissection

Cave & Rookmaaker 1977: 142-154 (Gordon's dissection of 1780 compared with recent data). Davies 1953 (foetus). Giebel 1855. Grassé 1955: 1108-1118. Rookmaaker & Groves 1978: 122 (review). Sparrman 1778, 1977, II: 83-86 (dissection of young Cape animal). Talbot & Talbot 1961 (weight of viscera). Wilson & Edwards 1965 (size and weight of internal organs, Zambian female).

6.5.2 Organs

Brain: Friant 1950. Holl 1900: 328, fig. 24. Oboussier 1956.

Epipharynx: Cave 1973: 655, 1974a: 136-139, 1974b.

Eye: Sparrman 1977, II: 91.

Heart: Cave 1981 (cardiac receptor system).

Hypophysis: Oboussier 1956.

Kidney: Meinertz 1972a.

Lymph: Cave & Aumonier 1962a: 212-213 (histology), 1963b (structure).

Mammæ: Ansell 1960a: 254.

Musculature: Kingdon 1979: fig. p. 84. Kyou-Jouffroy 1971. Meinertz 1972b (facial muscles).

Parathyroid: Cave 1976b: 437-439. Cave & Aumonier 1966 (histology).

Penis: Allamand 1781: 11. Camper 1782: 173. Cave 1964b: 577-581. Cave & Aumonier 1964c: 58. Kolb 1958: 381. Kuiper & Schneider 1940. Lönnberg 1912b: 29-31. Smith 1940, II: 58. Sparrman 1778, 1779, (1787) 1977, II: 90-91.

Placenta: Davies 1952. Ludwig 1962.

Postcava: Cave 1975: 561-562.
Reproductive organs: Kolb 1958: 381.
Salivary glands: Cave 1982.
Skin: Hiley 1977.
Sweat glands: Hiley 1977.
Stomach: Kolb 1958: 381.
Temporo-pterygoid ligament: Cave 1979b: 523.
Thymus: Cave 1963b, 1964a: 79-81.
Thyroid: Cave 1976b: 437-439, 1976c.
Tongue: Cave 1977: 274-281, 1980 (musculature).
Tonsils: Cave 1979a: 493-497.

6.6 OSTEOLOGY

6.6.1 Skull

de Beaux 1923: 287. Blumenbach 1810, pl. 7 (after Camper). Camper 1780, 1782. Cave 1959: 2 (foramen ovale distinct), 1965: 504 (lacrima epiphysis). Cuvier 1812b, 1st pl., 1836b, pl. 42 fig. 6, 7 (skulls Paris museum). Guérin 1980: 33-54 (description and size). Loose 1975: 8. Pander & d'Alton 1821: 21, pl. 9d. von Schreber 1835: 338. Schwarz 1920: 867-869 (characters, including foetus). Sparrman (1787) 1977, II: 86. Thenius 1955a (ossification of nasal septum). Zeuner 1934: 44-47 (ontogenesis of skull shape). Zukowsky 1922.

6.6.2 Skull measurements

Anderson 1966 (Zululand). de Beaux 1923: 288 (Somalia). Goddard 1970a: 106-108, 109-113 (Kenya). Gray 1868: 1032. Groves 1967b: 268. Guérin 1980: 49, 52. Hooijer 1973: 158, 161. Hopwood 1939: 448-449. Joubert 1970: 31-33 (N. Namibia and Natal). Lönnberg 1912a: 121. Loose 1975: 9-11, tab. 10 (Zeuner's angles in quartiles). Roberts 1951: 569. Rode 1944: 162. Rookmaaker & Groves 1978: 118-120 (D.b. bicornis). Schwarz 1920: 871. Zukowsky 1965: passim and tables between pp. 151 and 153.

6.6.3 Dentition

Allamand 1781: 11. Anderson 1966 (tooth replacement, dental formula, size, rudimentary incisors). de Beaux 1923: 287. de Blainville 1846: 51-58. Cave & Rookmaaker 1977: 141. Cooke 1950: 401. Cuvier 1812a, 2nd pl., 1836b, pl. 40. Dittrich 1974: 289-292 (eruption of deciduous dentition, rudimentary incisors, change of teeth). Falconer 1868, II: 403. Faujas-St. Fond 1809: 197 (number of teeth). Foster 1965 (seasonal changes in formation of molars). Goddard 1970a: 109 (dentition, eruption of teeth). Gray 1869c (rudimentary lower incisor). Groves 1967b: 271 (measurements). Groves & Rookmaaker 1978: 120. Guérin 1980: 54-73 (description, measurements). Haltenorth et al. 1979: 104. Hitchens 1978 (eruption, number of teeth, attrition). Hooijer & Patterson 1972: 18, 23, 24 (M² shape, size). Loose 1975: 8. Mohr 1950: 87, fig. 2-7 (milk molar). Owen 1845: 587ff. Ritchie 1963: 55. Rode 1944: 162. Schaurte 1966 (dental formula, development of teeth, size, structure). Schwarz 1920: 868. Vrolik 1830 (number of teeth, rudimentary lower incisor in some skulls). Wilson & Edwards 1965.

6.6.4 Postcranial skeleton

Cuvier 1822: 29-36. Davies 1953: 609 (foetus, skeleton). Giebel 1851 (comparison

with *R. tichorrhinus*). Grassé 1955: 1111-1113. Groves & Rookmaaker 1978: 120. Guérin 1966, 1980: 74-152 (description of bones, measurements). Heller 1913: 15 (vertebral formula). Hooijer & Patterson 1972: 24 (humerus length). Kyou-Jouffroy 1971 (vertebral formula). Pouchet & Beauregard 1889: 198-200. Virchow 1910 (vertebral column of Ethiopian animal). Vrolik 1830 (number of ribs, 20-21).

6.7 PHYSIOLOGY

Bligh & Harthoorn 1965 (body temperature). Condy 1964: 31 (heart beats, respiration). Denney 1969: 163 (respiration, pulse, temperature), 1970: 215 (rectal temperature). Haigh 1977 (respiratory rate, rectal temperature, pulse rate). Hiley 1977 (thermoregulatory response to diurnal temperature change). Hofmeyr et al. 1975: 39 (rectal temperature, respiration, pulse rate before and after immobilisation). Howard 1964: 48 (copper content of liver). Jayasinghe & Silva 1972 (electrocardiogram, 12 year old male). Jones 1979: 242, 245 (vit. A and copper levels; haemoglobin and serum biochemistry). Kolb 1958 (body temperature, respiration, pulse, field of vision, blood smear, composition of urine and dung). Nelson 1978: 767 (blood parameters). Osterhoff & Keep 1970 (blood proteins). Osterhoff et al. 1972 (haemoglobins, 2 types). Silberman & Fulton 1979 (blood constituents, rectal temperature).

6.8 GENETICS

Heinichen 1969 (karyotype, 2n=84), 1970: 72-74, 93 (chromosomes). Hungerford et al. 1967 (chromosomes, 2n=84).

6.9 DISTRIBUTION AND STATUS

6.9.1 Review and general reports

Anon. 1961, 1963c, 1979 (status). Ansell 1967: 4-5. Bothma 1975: 89 (status S. Africa). Brooks 1967: 18. Dollman 1921: 82. Dorst & Dandelot 1970: 197. Fitter 1968: 34 (status). Grzimek 1958: 118 (status). Haltenorth & Trense 1956: 206. Haltenorth et al. 1979: 104. Harper 1945: 396-402 (review). Heck 1896: 1022. Hillman 1980a, 1980b, 1981 (status, conservation). Jeannin 1951: 123, 129. Kingdon 1979: 93 (map). Kirk 1968: 151. Klingel 1979 (review of present status). Klös & Frese 1981b: 5, 20 (status, map). Llopis 1974c. Mauny 1956: 257. Murray 1866: 338. de Pousargues 1897: 136-138. Ritchie 1963: 54. von Schreber 1835: 339. Simon 1966. Speke 1863: 106. Spinage 1962 (status). Ward 1896: 284.

6.9.2 Angola

Review: Hill & Carter 1941: 148. Monard 1935: 257. Sidney 1965: 63-64. Zukowsky 1965: 69, 73, 75, 78-79.

Status: Anon. 1961 (in 1960). Hillman 1980a: 71. Silva 1952: 345. Simon 1966. Wilhelm 1950: 12.

'Angola' only: Anon. 1967c. Guggisberg 1966a: 48. Johnston 1882: 4. Lavauden 1932.

Records: du Bocage 1890: 23 (in south). Hill & Carter 1941: 148 (south; not collected by American Museum expedition). Johnston 1906a: 712 note (lower R. Cunene, 1882). Mattenklodt 1936a: 100, 103 (Lujana), 1936b: 146-149 (R. Lombo,

between Quito and Kuando). Möller 1974: 102, 186 (R. Kalonga). da Silva 1952: 345, 346 (Moçâmedes dt., S. and S.E. Angola). Statham 1922: 239, 254 (localities in S. and S.E. Angola). Wilhelm 1950: 12 (S.E. Angola). Zukowsky 1924: 81 (Hukwefeld).

6.9.3 Botswana

Review: von Richter 1973. Sidney 1965: 67. Smithers 1968: 96, 1971: 200. Zukowsky 1965: 75-79.

Status: Hillman 1980a: 71. Rautenbach 1971: 6. von Richter 1973. Simon 1966. 'Botswana' only: Guggisberg 1966a: 48.

Records: Andersson 1856: 387-395 (Ngami), 1861: 117 (R. Okavango), 1946. Baines 1864: 153, 395 (S.W. of Lake Ngami; near Secakuama). Bryden 1893: 490 (R. Chobe, lake Ngami). Nicolls & Eglinton 1892: 63 (Chobe). Rautenbach 1971: 6 (north). Selous 1876: 179 (Tamusanka, R. Gwai, R. Chobe), 1893: 455 (R. Chobe).

6.9.4 Cameroon

Review: Dekeyser 1955: 314. Sidney 1965: 80-81. Zukowsky 1965: 155.

Status: Anon. 1961 (in 1958). Blancou 1960: 101. Hillman 1980a: 71. Simon 1966.

Hunting: Jeannin 1936: 34.

'Cameroon' only: Guggisberg 1966a: 53.

Records: Augiéras 1935: 61 (Garoua). Bourgoïn 1955: 63 (central and N.E.). Happold 1973: 89. Jeannin 1930: 165 (south of R. Bénoué), 1936: 33 (north of R. Bénoué), 1945: 105 (localities in north). Kieffer 1953: 272 (reserves Boubandjiddé, Benoué, Faro). Lavauden 1932 (N.W.). van Lavieren & Bosch 1977: 9, 10 (Bouba Ndjida N.P.). Lieurade 1935: 4 (Logone-Birmi). Mauny 1956: 259 (early reports). Meyer 1909. Rode 1944: 164 (north). Zukowsky 1949 (Garoua). Zwilling 1940: 368 (localities in north).

6.9.5 Central African Republic (A.E.F.)

Review: Blancou 1960: 102. Sidney 1965: 79-80. Zukowsky 1965: 153.

Status: Anon. 1961 (in 1958). Blancou 1933: 19, 1958b: 404, 1960: 102. Bourgoïn 1955: 63. Hillman 1980a: 71. Pfeffer 1981. Simon 1966.

Records: Anna 1950 (Ouham dt.). Augiéras 1935: 62 (R. Oubangui). Blancou 1932: 201 (R. Chari, R. Ouaka, possibly R. Kotto), 1933: 19 (Ouaka dt., not in Kotto basin), 1935a: 54, 58 (absent from west; N. Ouaka dt., Koukourou to Ndélé), 1948: 11-12 (Oubangui-Chari, 1933-48, localities), 1958a: 312 (north of 7° N). Bourgoïn 1955: 63 (central and east). Félix 1953: 58 (Biraodt.). Fourcau 1905: 1049 (Gribingui). Jeannin 1945: 105-106 (localities). Pfeffer 1981 (localities). Rode 1944: 164 (south of Ndélé).

6.9.6 Chad

Review: Dekeyser 1955: 314. Malbrant 1930: 353, 1936: 23. Zukowsky 1965: 144, 151, 156.

Status: Blancou 1958b: 404, 1960: 101. Bourgoïn 1955: 63, 1958: 374. Gromier 1933: 268. Hillman 1980a: 71. Pécaud 1925: 75. Simon 1966.

Hunting: Augiéras 1935: 62-63. Carbou 1912: 69. George 1946.

'Chad' only: Bigourdan & Prunier 1937. Denham & Clapperton 1826: 194. Freydenberg 1908: 149. Guggisberg 1966a: 53.

Records: Adolf Friedrich 1921: 132 (localities). Alexander 1907: 300, 394 (R. Chari). Augiéras 1935: 61 (R. Chari). Barth 1857: 278 (Logone). Blancou 1948: 11

(Oubangui-Chari, localities), 1958a: 312 (south). Carbou 1912: 69 (west). Fourcau 1905 (Kanem, R. Chari). George 1946: 127-139, pl. facing p. 157 (central). Kumm 1910: 136, 307 (R. Chari). Kund 1906: 4 (Bal Ili). Lavauden 1934: 436 (localities). Nachtigal 1881: 554 (absent from Logone). Pécaud 1925: 75 (localities). Rode 1944: 164 (S.E. of Melfi). Rohlf's 1874: 331 (near Lake Chad). Schubotz 1912: 348 (R. Chari). Schultze 1913: 126 (west). Schwarz 1920: 867 (Moghrum, Modgel, Damran). Zukowsky 1949 (localities).

6.9.7 Congo (Brazzaville)

Blancou 1954 (Kellé, Ouessou, Dongon dts.), 1958a: 313 (north, present until recently). Cameron 1877: 202 (Ngombé 1874, 'huge white rhino'). Simon 1966 (status).

6.9.8 Ethiopia

Review: Guggisberg 1966a: 52. von Heuglin 1861: 15. Sidney 1965: 76-77.

Status: Anon. 1961 (in 1960). Hillman 1980a: 71. Simon 1966.

Hunting: Baker 1872: 242-248 (by Hamrans), 1890: 93, 105-111. Blanford 1870: 121-123. Potocki 1897: 102.

'Ethiopia' only: Blanford 1869. Drummond 1876. Lavauden 1932, 1934: 435. des Murs et al. 1850: 26.

Records: Baker 1872: 299, 328 (R. Royan, Mt. Nahoot Guddabi). Blanford 1870: 243 (R. Anseba). Blower 1968: 280 (Omo valley, Wollega prov.). Bolton 1973: 571 (R. Mwi 1967, 1973; Mago valley). Bruce 1790: 86 (north and central, localities). Drake-Brockman 1909: 113 (W. Ogaden, S. Boran), 1910: 106 (Haud valley; Ogaden). Escherich 1921: 33 (R. Omo, R. Awash). Hartmann 1868: 363 (N.W.). von Heuglin 1877: 93 (R. Anseba). Maydon 1932: 235 (Ogaden). Parkyns 1854: 248 (Tigre prov.). Peel 1900: 298 (E. Ogaden). Potocki 1900: 81, 102 (Ogaden). Roosevelt & Heller 1915, II: 656 (south). von Rosen 1953: 38 (western and southern border). Schomber 1963: 32 (west). Smith 1897: 30, 179, 213, 226, 229, 235, 238, 251 (Bodele; near Mt. Elwak; near Lake Stephanie). Sorrell 1952: 288 (south). Swayne 1894: 321-322 (localities), 1895: 297 (localities). Urban & Brown 1968: 346 (Omo valley). Zukowsky 1965: 125, 127, 139 (Ogaden; R. Anseba).

6.9.9 Ivory Coast

Review: Sidney 1965: 81.

Records: Bigourdan & Prunier 1937 (north). Blancou 1960: 101 (once present). Dekeyser 1955: 316 (Bouna). Jeannin 1945: 105 (Bouna, 1905). Guggisberg 1966a: 53 (last shot Bouna, 1905).

6.9.10 Kenya

Review: Guggisberg 1966a: 50-51. Kingdon 1979: 94 (map). Sidney 1965: 74-76. Simon 1962: 254-257. Stewart & Stewart 1963: 8, map (distribution ca. 1885). Stigand 1909: 283. Zukowsky 1965: 101-105 (Massailand), 117-119 (north).

Status: Anon. 1961 (in 1960). Hill 1979. Hillman 1980a: 71. Hillman & Martin 1979. Martin 1980a. Simon 1966. Stockley 1948: 25. Stonehouse 1981: 62. Swara & Hillman 1979.

Hunting: Anon. 1930a (poisoned arrows). Bennet 1914: 185. Chapman 1908: 91, 139, 169, 244. Hunter 1953: 155-175. Maydon 1932: 132. Neumann in Bryden 1899: 47 (Ndorobos). Ritchie 1963: 61. Schillings 1925: 97-119. Schoeller 1904. Stockley 1948: 26-34. Tjader 1911: 132.

Legislation: Grzimek 1965 (rhino not to be shot without license). Hill 1979. Ritchie 1963: 72 (trade in horns). Sandeman 1959 (attempt to stop illegal hunting).

Translocation: Anon. 1967f, 1968e (to Nairobi N.P. 1968). Brooks 1967: 17. Buechner et al. 1960: 264 (to North Frontier prov.). Carter 1965. Hamilton & King 1969, 1970. Harthoorn 1968: 219. King 1969. Möller 1966 (to S. Africa, 1961). Russell 1967a, b. Sutherst 1964 (to Tsavo N.P.).

'Kenya' only: Anon. 1930a. Dugmore 1910. Hobley 1922: 6. Johnston 1906a: 292. Lavauden 1932, 1934: 435. Lugard 1893: 517, 520. Ritchie 1931. Stott 1950b.

Records: Anon. 1952 (Kibwezi), 1977a (Amboseli). Arkell-Hardwick 1903: 28, 45, 164, *passim* (R. Tana; Uaso Nyiro). Astley-Maberly 1961: 20 (Nairobi N.P.). Bayer 1924: 6 (Mt. Elgon). Bennet 1914: 187 (localities). Berger 1910a: 217 (Lake Baringo; R. Uaso Nyiro), 1910b: 343 (Lake Solai). Bourlière 1965a (Tsavo, status 1961-63), 1965b (Samburu, census 1961). Broun 1905: 297 (Nyambeni mts., Aberdares). Chapman 1908: 91-96, 139, 169, 244 (Baringo, Lake Elmenteita, Lake Solai, R. Simba). Darling 1960: 21 (R. Tiva). Davies 1953: 593 (Pundu Milia). von der Decken 1869: 257 (Lake Jipe). Dickinson 1907: 80-82 (Laikipia, R. Tana, Uaso Nyiro). Dracopoli 1914: 247, 259 (Uaso Nyiro south bank). Dugmore 1925: 119, 163, 178, 198, 207, 226 (Marsabit, Nanyiki, Guaso Nyiro, R. Tana). Elliot 1896: 18 (Kikuyu country). Foster 1965: 118 (Tsavo East, reduction due to drought 1961). Glover 1970: 324 (Tsavo). Goddard 1969a (Tsavo), 1970a: 105 (Tsavo, decline 1960-61), 1970d (Tsavo). Graham 1929: 164 (mangrove swamps near coast). Gregory 1896: 113, 266, 269, 270 (near Lake Victoria, Laikipia dt., Lake Losuguta, Kapti Plains). Grogan & Sharp 1900: 197 (Lake Rudolph). Gromier 1934: 356 (Tsavo). Guggisberg 1966c (Amboseli). Hamilton & King 1969, 1970 (Nairobi N.P.). Haywood 1927: 117, 164 (Laikipia). von Höhnel 1892: 92, 118, 191, 612, *passim* (localities). Hunter 1953: 155, 174 (Machakos dt.). Johnston 1886: 393 (Taveita), 354, (base of Kilimanjaro). Kearney & Vyvyan 1965 (Voi, Tsavo). Kenya Game dept. 1937 (Nyeri dt.). Lönnberg 1912a: 119 (Uaso Nyiro). Maxwell 1924: 91 (Uaso Nyiro). Maydon 1932: 115 (Baringo dt.). Morcau 1944: 73 (Mt. Kenya, up to 10,500 ft.). Mukinya 1973: 391 (Masai Mara G.R., census 1972). A. Neumann 1898 (localities). O. Neumann 1900: 556 (Kavirondo). Neveu-Lemaire 1924a (near Lake Rudolph). Pocock 1928a (Mt. Kenya). Roosevelt 1910a: 88-94 (Wakamba area). Roosevelt & Heller 1915, II: 640, 651, 656 (localities). Russell 1967a (R. Athi). Schillings 1925: 105, 106 (Kibwezi, Lake Jipe). Schoeller 1901, I: 11-26 (south). Schomburgk 1910: 345, 363 (Mua hills, R. Ulanga). Smith 1897: 311, 332, 339, 347, 350, 359 (Lake Rudolf, Mt. Kulol, Guaso Nyiro). T. Smith 1965: 115 (Voi). Stockley 1950: 88 (R. Tana, Mt. Kenya, Embu). Stott 1950b: 189 (Nyeri dt., Wamba). Sutherst 1964 (Tsavo). Thomson 1883: 323 (Baringo), 130 (Masailand). Tjader 1911: 131, 132 (Laikipia, Sotik plain). True 1893: 479 (Taveta). Vandeleur 1898: 147 (Athi). van de Werken 1966a (Tsavo), 1966b (Amboseli), 1968 (Amboseli). Western & Sindiyo 1972 (Amboseli, census). Wickenburg 1899: 410 (Tsavo, Lake Jipe). Willoughby 1889 (Taveta-Kilimanjaro region). Woodhouse 1912: 31 (R. Yala), 1916: 74 (Tsavo).

6.9.11 Liberia

Johnston 1906b: 712 (presence asserted by Mandingos of northern parts). Maugham 1920: 176 (absent). Sidney 1965: 81.

6.9.12 Malawi (Nyasaland)

Review: Sidney 1965: 67, map 17. Zukowsky 1965: 92-93.

Status: Guggisberg 1966a: 48 (now extinct). Hillman 1980a: 72. Lugard 1893: 517. Simon 1966.

Records: Ansell et al. 1962: 46 (Karonga dt.). Evans 1979: 29 (Muaboi G.R.). Lyell 1912: 34 (N. Angoniland). Murray 1932: 329 (Kota-kota dt., Ngama dt., Nyika plateau). Schomburgk 1910: 233 (Lake Nyassa). Smithers & Tello 1976: 112 (central and south).

6.9.13 Mozambique

Review: Sidney 1965: 65-67, map 16. Smithers & Tello 1976: 112. Zukowsky 1965: 87-91.

Status: Anon. 1961 (in 1959). Hillman 1980a: 72. Simon 1966.

'Mozambique' only: Fitzsimons 1920: 214. Haagner 1920: 126. Kirk 1864: 655. Peters 1856.

Records: de Alcantara 1956: 302 (Gorongosa N.P.). Drummond 1876 (south of Limpopo). Fajardo 1953: 332 (Gorongosa N.P.). Gomes e Sousa 1955: 35 (Gorongosa N.P., Alto Molocué N.P.). Grogan & Sharp 1900: 52 (Mt. Chipirone). Kirby 1899: 337 (north). Kirby in Bryden 1899: 38 (localities). Maugham 1910: 247 (Zambezia dt., localities). Nicolls & Eglinton 1892: 63 (Sofala bay). Peters 1852: 179 (south of 17° S). Stevenson-Hamilton 1950: 46 (localities in south). von Wissmann 1901: 113 (Kionga delta).

6.9.14 Namibia

Review: Gaerdes 1967. Joubert 1971. Sauer 1972. Sidney 1965: 64-65. Zukowsky 1965: 49-55, 65, 78.

Status: Anon. 1961 (in 1958), 1972d. Brand 1964a: 69, 1964b (in 1934). Hall-Martin 1979: 30. Hillman 1980a: 72. Simon 1966.

Hunting: Steinhart 1920: 80.

Translocation: Hofmeyr 1975: 126-129 (to Etosha N.P.). Hofmeyr & de Bruine 1973 (to Etosha N.P.). Hofmeyr et al. 1975 (to Etosha N.P., 1970-72).

Records: Alexander 1838, I: 191, 299 (Chuntop and Fish R.), II: 56-59 (R. Kuiseb). Barnard 1952 (W. Kaoko). Bigalke 1958: 486 (Caprivi, Kaoko). Eloff 1977: 88 (Kaoko). Fischer 1914: 119-123 (Caprivi, Kaoko). Gaerdes 1966: 232 (map). Galton 1853: 267, 269, 270 (near Tounobis). Guggisberg 1966a: 48 (Caprivi). Hall-Martin 1979: 30 (Kaoko). Heinz 1933: 270, 275 (Kolmanskop). Hofmeyr 1975: 128 (Etosha N.P.). Joubert & Eloff 1971 (Etosha N.P.). Kuntz 1913: 447 (Kaokofeld, up to R. Ugab). Kunze 1909: 14 (Amboland, Kaokofeld). Levailant 1795, III: 53 (one shot north of Orange river). Lundholm 1951: 183 (W. Kaoko). Range 1914: 65 (Namaland). Rautenbach 1971: 6 (R. Kuanda, wanderer from Botswana). von Richter 1973 (Caprivi). Sauer 1972 (R. Tumas). Shortridge 1934: 413 (Kaokofeld), 1942: 72 (Great Namaqualand 1779, 1895). Steinhart 1920: 32, 42 (Kaoko). Thomas 1929: 110 (Otjiwan). Tinley 1971: 16. Wilhelm 1933: 55, 1950: 12 (Caprivi, localities). Zukowsky 1924: 80 (Kaoko, localities), 1965: 65-67, 78 (Kaoko, Caprivi).

6.9.15 Niger

Bigourdan & Prunier 1937 (localities). Blancou 1960: 101 (once present). Dekeyser 1955: 314. Guggisberg 1966a: 53 (Djerma-Ganda). Lavauden 1934: 436 (N.W. of Lake Chad).

6.9.16 Nigeria

Review: Mauny 1956: 259 (early reports). Sidney 1965: 81.

Status: Blancou 1960: 101. Bourgoin 1958: 374. Happold 1973: 89 (extinct).

Haywood 1932: 32. Shorthose 1932.

Records: Augiéras 1935: 61 (Benoué). Blancou 1960: 101 (north). Denham & Clapperton 1826: 194 (Borno). F.C. 1940: 14 (Gongola; north of Ogaja until 1925). Foureau 1905: 1033 (Borno). Haywood 1932: 32 (Bornu, Andamawa, Bauchi junction). Johnston 1906b: 712 (N.E.). Lang 1920: 77 (Niger-Chari dts.). Nachtigal 1881: 386 (Borno). Rode 1944: 164 (around lake Chad). Rosevear 1939: 107 (Lake Chad region), 1953: 120, fig. 208 (N.E.). Schultze 1913: 126 (N.E., Borno-Yola). Shorthose 1931 (North; north of Yola in east), 1932 (north of Yola).

6.9.17 Rwanda and Burundi

Anon. 1961 (Rwanda, status 1959). Haezaert 1959 (translocation to Rwanda). Hillman 1980a: 72 (status). B. Kinloch 1967: 217 (Kagera N.P.). Schouteden 1943: 115 (Burundi), 1945: 265. Verschuren 1978: 217 (now absent from Burundi).

6.9.18 Somalia and Somaliland

Review: Funaioli & Simonetta 1961: 110, 1966: 296, fig. 4A. Guggisberg 1966a: 52. Sidney 1965: 76. Zukowsky 1965: 125-127.

Status: Anon. 1961 (in 1960). Hillman 1980a: 72. Simon 1966.

Hunting: Cox 1900: 93-99. Ghika 1898. Peel 1900: 298. Potocki 1897: 102, 1900: 81, 102. A.H. Straker in Bryden 1899: 49-52. Zammarano 1932, 1934: 219.

'Somalia' only: Drake-Brockman 1910: 106. Lavauden 1932, 1934: 435.

Records: J. Allen 1914: 403 (Cheringangi hills). Cox 1900: 93 (Burao; N.W. prov.). Drake-Brockman 1910: 106 (N.W. prov.). Ghika 1898: 177, 178 (N.W. and N.E. provinces). von Heuglin 1861: 15 (localities). Maydon 1932: 235 (Toyo plains in Ogo). Peel 1900: 298 (localities). A.H. Straker in Bryden 1899: 48 (Haud, Webbi Sheybelli). Swayne 1894: 321 (N.W. and N.E. provinces), 1895: 297 (N.W. and N.E. provinces). Turner 1937: 59 (near boundary pillar 84 of British Somaliland). Ward & Sorrell 1950: 33 (S. Jubaland). Wickenburg 1899: 409 (localities). Zammarano 1924: 174, 219-226 (Uebi Scebeli), 1930: 169 (localities), 1932: 55, 88 (Mahaddei).

6.9.19 South Africa

Review: Brand 1964b: 69. Buckley 1876: 291. Guggisberg 1966a: 46-48. Hitchins 1975. Hitchins et al. 1972: 18. Sidney 1965: 63.

Status: Anon. 1961 (in 1959). Brand 1964a: 2, 1964b: 69. Hall-Martin 1979. Hillman 1980a: 72. Simon 1966. Zukowsky 1965: 37, 48.

Hunting: Alexander 1838, I: 299, II: 3, 56. Baldwin 1894. Drummond 1875: 75-136. Fitzsimons 1920: 216-219. Gatti 1965: 79-85. Sparrman (1787) 1977, II: 87-89.

Translocation: Anon. 1970g (Zululand). Dixon 1966: 32 (to Ndumu G.R.). Hall-Martin 1979 (to S. African reserves). Hall-Martin & Penzhorn 1977 (to Addo Elephant N.P. 1961-62). Havenga 1970 (need in Kruger N.P.). Hitchins 1975. Hitchins et al. 1972 (to Kruger N.P.). Keep 1973a (Hluhluwe to Kruger N.P.). Keep et al. 1969 (Zululand). Möller 1966 (to S. Africa, 1961-62). Player 1967: 149 (Zululand). Verwey 1971. de Vos 1980 (to Kruger N.P.). de Vos & Braack 1980 (to Addo Bush N.P. 1977).

'South Africa' only: Barrow 1807: 345. Bogaert 1711: 104. Frik 1692: 33. Hesse 1690: 33. Layard 1861: 61. Methuen 1846: 152, 164, 193. Percival 1804: 158. de Rennefort 1702: 306. Smith 1833: 179. Smuts 1832: 61. Sonnerat 1782, II: 92. Steedman 1835, I: 69. Thunberg 1811: 320.

General records: Chapman 1868: 61 (R. Botletlie). Harris 1839: 371 (interior).

Roberts 1951: 242. Selous 1897: 125.

Cape Province records: Allamand 1781, 1782, 1785 (R. Gamka, not near Cape Town). Barrow 1806, II: 169 (Sitsikamma). Bateman 1961 (extinct in some dts.). Bigalke 1950: 5, 7 (early records). Blumenbach 1788: 136, 1797: 126 (Cape). Borchers 1979: 219 (N. Cape prov.). Bryden 1889: 286 (Cape, S. Cape prov.; last Addo Bush 1849). Burchell 1824, II: 126 (near boundary), 1836: 4 (Moshowa R. 1812). Cave 1947: 145 (Chuë Spring, Hot Station, shot by Burchell in 1812). Dollman 1921: 82 (extinct 1853). Fitzsimons 1920: 214 (last shot 1853). Forbes 1965 (18th century records). Forbes & Rourke 1980: 107, 124, 127, 136, 164, 166 (travel of William Paterson). Grobbelaar 1924: 177-180 (early records). Levaillant 1795, III: 56 (Quammedacka). Lichtenstein 1811, I: 558, 583, 590, II: 342 (Great Fish R., Karroo, Schietfontein). Mentzel 1921: 15, 27 (Cape 1785). Molsbergen 1916-1932 (early records 1652-1805). Mossop 1935: 98, 287, 318 (Cape 1760, 1779, 1792), 1947: 48 (Cape 1761). Paterson 1790: 49, 83, 88, 95, 126, 128 (localities). Raven-Hart 1971 (early records 1652-1702). van Riebeeck 1952, I: 68, 169, 268, 1955, II: 182, 1957, III: 470 (Cape). W. Sclater 1900: 305. Shortridge 1934: 415 (Uitenhage dt.). 1942: 72 (Little Namaqualand). Skead 1958 (Uitenhage and Cradock dts. extinct). Smith 1836: 44 (Kurrichaine), 1837: 8, 1838, 1939-40 (expedition 1834-36). Somerville 1979: 73 (near Prieska), 105, 106, 162 (between Prieska and Kuruman), 191 (Carnarvon). Sparrman 1778, (1787) 1977, II: 76 (Quammedacka). Wahlberg 1845: 422-427 (Moriqa, Montili).

Natal records: Anon. 1970g (Hluhluwe). Attwell 1947: 26 (Hluhluwe, Mkuzi), 1948: 37 (Hluhluwe, Mkuzi). Baldwin 1894: 99, 102, 180 (N. Natal 1855-56). Bourquin et al. 1971: 34, fig. 36. Brand 1964a, b. Buckley 1876: 291. Cowles 1959. Delegorgue 1847, II: 416-420. Dixon 1964: 48 (Mkuzi G.R.) Drummond 1875: 121, 1876 (N. Natal). Ellerman 1954: 79. Findlay 1903: 183, 188 (Zululand localities). Fitzsimons 1920: 214 (Zululand). Gordon-Cumming 1850, I: 249-251. Grout 1863: 295. Haagner 1920: 126. Hitchins 1968a (Hluhluwe), 1975 (status). Hobley 1926: 44 (status). Kluge 1950: 159 (Umfolozzi). Mentis 1970 (Umfolozzi). van der Merwe 1962. Natal Parks Board 1953: 21 (Hluhluwe). Potter 1949: 128 (Hluhluwe). Ripley 1958: 173 (Umfolozzi, Hluhluwe). Stott 1963 (Umfolozzi). Swanepoel 1955 (Hluhluwe). Zukowsky 1965: 41-49 (localities).

Orange Freestate records: Fitzsimons 1920: 214 (last shot 1842). W. Sclater 1900: 306 (last shot 1842).

Transvaal records: Anon. 1960b: 81 (extinct in Kruger park). Bigalke 1947b: 221 (Kruger N.P. to 1938). Bryden 1889: 286 (Kaffraria). Drummond 1875: 125 (inland of Lourenzo Marques). Fitzsimons 1920: 214. Grzimek 1960a: 21 (Kruger N.P. last seen 1920's). Haagner 1920: 126 (East). Hall-Martin 1979: 28 (Kruger N.P.). Harris 1840: 82 (Limpopo valley). Kirby 1896: 550 (localities, last shot R. Manunga 1891). Kirby in Bryden 1899: 38 (N.E.). Lavauden 1932 (N.W.). Lichtenstein 1811, I: 154 (Hartebeesfontein). Lownds 1952: 54 (Kruger N.P. to 1936). Möller 1974: 36 (R. Limpopo). Pease 1908: 32 (Sabi G.R.; Barberton 1904). Pienaar 1963: 22 (Kruger N.P.). Selous 1893: 99 (R. Sabi). Smith 1837: 8 (Lattakoo). S.A. nat. parks board 1936 (Kruger N.P.). Stevenson-Hamilton 1950: 46 (Kruger area).

6.9.20 Sudan

Review: Guggisberg 1966a: 52-53. Sidney 1965: 78. Zukowsky 1965: 122, 129-130, 139-142.

Status: Anon. 1961 (in 1953). Benzon 1947. Hillman 1980a: 72. Maydon 1932: 139. Schomber 1963: 34. Simon 1966.

'Sudan' only: Browne 1799: 260 (empire of Fûr). Johnston 1906b: 712. Myers 1876: 115, 147, 149, 255, 271. Schomber 1962: 149.

Records: Anon. 1946 (Torit, Mongalla). G. Allen 1914: 324 (West Nile dt.). Arkell 1937: 284 (N. Darfur rock painting; Zaghawa 1850 incorrect). Audas 1951: 14 (Wadi Maarna, N. Darfur). Barth 1857: 278 (west). Benzon 1947 (Bahr el Ghazal, north of R. Lol). Burckhardt 1822: 433 (Bahr el Ghazal). Chapman 1921: 282 (Bor). Forbes 1947 (west of Wan), 1949: 14 (Nimule G.R.; Gogrial 1947), 1950: 27 (Dinder dt., 1905-06). Gleichen 1905: 98, 109, 110, 148, 151, 161, 181, 307 (localities). Hartmann 1868: 363 (Blue Nile and West Nile dts. localities). von Heuglin 1877: 93 (east, localities). Larken 1947 (Rumbek dt.) Mackenzie 1950 (S. Bahr el Ghazal), 1954: 20, map 66 (prov. Equatoria and N. Bahr el Ghazal). Malbrant 1936: 23 (Bahr el Ghazal, last killed 1916). Maydon 1932: 139 (West Nile dt.). Owen 1947 (east bank only; one shot on west bank by Danish expedition). T. Owen 1949: 34 (Nimule G.R.), 1950: 24 (Bahrel Ghazal). Schomber 1963: 34 (S.E. corner, near R. Lol). Setzer 1956: 570 (Sennar; between Juba and R. Tori). Sutcliffe 1952: 21 (Aliab valley). Wilson 1979: 330 (S. Darfur prov.), 1980: 96 (N. Darfur prov., one improbable record).

6.9.21 Tanzania

Review: Guggisberg 1966a: 49. Kingdon 1979: 94 (map). Sidney 1965: 72-74. Swynnerton & Hayman 1951: 339. Zukowsky 1965: 100-105.

Status: Anon. 1961 (in 1960), 1965c (Ngorongoro, Olduvai). Borner 1981. Frame 1971: 693 (Ngorongoro). Grzimek 1960a: 217 (Serengeti, Ngorongoro). Grzimek & Grzimek 1960 (census 1958). Goddard 1967a (Serengeti census), 1967b: 133 (Ngorongoro, Olduvai). Hillman 1980a: 72. Hillman & Martin 1979. Lithgow 1960, 1961 (Ngorongoro). Simon 1966. Swara & Hillman 1979: 24. Swynnerton 1959. Turner & Watson 1964: 166 (Ngorongoro).

Hunting: Kandt 1905: 249 (trap with spears). Koenig 1953: 55-71. Kuhnert 1920: 96-109. Schillings 1925: 97.

Legislation: Grzimek 1965 (may be shot with license). Sayers 1930: 404.

Translocation: Denney 1969. McCulloch & Achard 1969 (in 1962, 1964).

'Tanzania' only: Haagner 1920: 127. Knochenhauer 1903: 260. Koenig 1965. Lavauden 1932.

Records: Adolf Friedrich 1909: 32 (Karagwe; not found north or west of R. Kagera). Brauer 1910: 389, 391 (Karagwe 1908). Burton 1860, I: 87, 247, 289, 300, II: 15 (Usagara mts. Gogo dt., Nyamwezi dt.). Cameron 1877: 132 (Mgunda Mgali 1873). Delmé-Radcliffe 1904: 61 (south of R. Kagera), 1905: 185 (right bank of Kagera). Dugmore 1925: 17, 40 (Ngorongoro). Elliot 1895: 340 (Karagwe). Elton 1879: 310, 352 (south). Fonck 1924: 117 (N.W., S.E. and Karagwe). Frame 1980 (Serengeti). Goddard 1967a (Serengeti), 1967b (Ngorongoro, Olduvai). von Götzen 1895: 40, 49, 143 (R. Bubu; Karagwe; east). Grant 1872: 328 (between Ugogo and Karagwe). Grzimek 1963: 186 (Ngorongoro). Grzimek & Grzimek n.d.: 96 (Ngorongoro), 1960 (Serengeti). Heck 1930: 73 (between lake Manyara and Eyasi). Johnston 1886: 354, 393 (Kilimanjaro), 1906a: 292 (absent from south; formerly near Lake Rukwa). Kandt 1905: 249 (Karagwe). Klingel & Klingel 1966 (Ngorongoro). Koenig 1953: 55, 57 (Kilimanjaro, N. Paree mts.). Kuhnert 1920: 96 (Kilimanjaro 1892). Larken 1953: 49 (Sue). Laurent & Guérin 1974. Lavauden 1934: 435 (around Mahengue and Kilimanjaro). Lithgow 1961 (Ngorongoro). Makacha et al. 1979 (Ngorongoro). Mwalyosi 1977 (Lake Manyara N.P., census 1975). Neumann 1900: 556 (localities). Noack 1887: 195 (east of Lake Tanganyika).

Roosevelt & Heller 1915, II: 640, 651, 657 (localities). Sayers 1930: 404 (W. Bukoba, Shanwa, Serengeti). von Schellendorf 1916: 9 (Lake Jipe, Ugueno 1891). Schillings 1925: 96 (Kilimandscharo, Massai plain). Schomburgk 1910: 259 (R. Luwego). T. Smith 1965: 116 (Yaida swamp). Speke 1863: 619 (Karagwe under R. simus). Stott 1950b: 189 (Kilimanjaro). Swynnerton 1945: 79 (Usukuma). Thomas 1885: 221 (Kilimanjaro). Thomas & Scott 1935: 385 (south of R. Kagera). True 1893: 479 (Kilimanjaro). Verschuren 1978: 217 (border with Burundi). Watson & Turner 1965: 98 (Lake Manyara N.P.). von Wissmann 1901: 43 (Kilima Ndjaro, Ugogo). Woodhouse 1916: 74 (Serengeti). Zukowsky 1965: 94-95 (Rowuma).

6.9.22 Uganda

Review: Guggisberg 1966a: 51-52. Kingdon 1979: 94 (map). Sidney 1965: 77.

Status: Anon. 1961 (in 1960). Bere 1958: 419. Grzimek 1965. Hillman 1980a: 73. Knowles 1911: 21. Malpas 1980. Owen 1956: 29. Simon 1966. Swara & Hillman 1979: 24.

'Uganda' only: Lavauden 1932, 1934: 435. Noack 1887: 195.

Records: Bere 1957: 12, 1958: 419 (Murchison Falls N.P.). Campbell 1957 (Karamoja 1925). Delme-Radcliffe 1904: 61 (north of R. Aswa). Field 1958 (Luyoro). Johnston 1902, I: 373-374 (north, as 'white rhino'). Knowles 1911: 21 (not west of Albert Nile). de Langsdorff 1910: 116-130, pl. 26 (Zokka). Malpas 1981: 234 (Kabalega Falls N.P., not seen). Owen 1956: 29 (Ankole, Lango, Muruzi). Roosevelt & Heller 1915, II: 615 (localities). Savidge 1964 (Kidepo valley N.P.). Shirley 1963 (Queen Elisabeth N.P.). Speke 1863: 619 (Madi dt.). Stigand 1909: 283 (not west of Nile; mt. Elgon). Stott 1950b: 189 (not west of Nile). Temple-Perkins 1956: 6 (east of Nile). Thomas & Scott 1935: 385 (Karamoja, Chua, Maruzi, Gulu). Watson 1949: 183-185 (Karamoja, Teso, localities). Zukowsky 1965: 100-101 (around Lake Victoria).

6.9.23 Zaire

Review: Sidney 1965: 78-79.

Status: Hillman 1980a: 73 (absent). Verschuren 1958: 409, 1975: 153 (extinct).

Hunting: Foa 1908: 412. Jobaert 1955.

Translocation: Grzimek 1963: 122 (Kenya to Congo 1962).

Records: Blancou 1954 (Dongou, 1 killed). Burrows 1898: 244 (Katanga, Manyema, M'boma). Foa 1908: 415 (S.E.). Guggisberg 1966a: 49 (Katanga). von Heuglin 1869: 302 (R. Kosanga; absent from Bongo). Jobaert 1955: 53 (Katanga 1910). Johnston 1908, I: 320, 349 (R. Lualaba, north of Mubangi-wele). Lang 1920: 27 (Uele), 1924b: 322 (extinct in Uele). Leplae 1925: 47 (Katanga 1912). Schouteden 1913: 284 (Kifumwazi, Katanga prov.), 1927: 24, 1943: 115 (Katanga), 1945: 264-265, fig. 287 (Katanga, localities; extinct in north). Verschuren 1975: 153 (Kabengele last shot 1957).

6.9.24 Zambia

Review: Ansell 1959b: 335-336, 1969, 1973, 1975, 1978: 50. Lancaster 1953: 46. Sidney 1965: 69-72, map 18. Zukowsky 1965: 79-80.

Status: Anon. 1961 (in 1958). Ansell 1952, 1957, 1960a, 1969, 1975, 1978. Darling 1960: 150. Grimwood et al. 1958. Guggisberg 1966a: 48. MacArtney 1970. Simon 1966.

'Zambia' only: Maydon 1932: 330.

Records: Aitkens 1905: 15, 21 (between R. Njoko and R. Lui; Batoka). Ansell

1952: 108-109, 1957: 24 (localities), 1960a: 52-53, map B (localities), 1965: 7 (N.W. province). Darling 1960: 14, 62, 73, 78, 150 (localities). Dowsett 1969: 221 (Luangwa valley). Gibbons 1898: 395 (Marotseland). Grimwood et al. 1958 (localities). Hughes 1933: 35, 193, 198, 229, 268 (Lake Bangweulu). Jordan 1959: 140-143 (localities). Letscher 1911: 61, 104, 106, 198 (R. Luangwa, Muchingas). Livingstone 1854: 300 (Barotse country). Lyell 1910: 49 (Machinga mts., R. Luangwa), 1912: 34 (N.E. Rhodesia), 1913: 163 (Machinga mts.). Mitchell 1966 (Luangwa valley G.R., Kafue N.P.). Schomburgk 1910: 185 (Lake Bangweolo). Sweeney 1959: 57 (localities in south and central provinces; possibly north prov.). Wroughton 1907: 32 (Luangwa valley).

6.9.25 Zimbabwe

Review: Fraser 1958: 470. Guggisberg 1966a: 48. Herbert & Austen 1972: 1-2. Kerr & Fothergill 1971. Roth 1967. Sidney 1965: 65. Zukowsky 1965: 79.

Status: Anon. 1961 (in 1959). Hillman 1980a: 72. Jackson 1972 (in 1968). Savory 1969: 25. Simon 1966.

Translocation: Anon. 1970a (to Gona re Zhou), 1970f (within Rhodesia), 1971a (to Gona re Zhou, 1970), 1971h (to Gona re Zhou N.P.), 1973d (in S. Rhodesia, 1970-71), 1973f (Zambesi valley to Gona re Zhou). Child & Savory 1964: 6 (to Wankie N.P. and Matopos N.P.). Condy 1964 (Lake Kariba). Davis 1972. Harthoorn & Lock 1960, 1962 (Lake Kariba). Herbert & Austen 1972: 2 (from Kariba, 1961-65). Jackson 1972 (to Gona re Zhou N.P.). Jones 1966 (Lake Kariba). Roth 1965 (Kariba to Wankie N.P. 1957), 1967: 228 (to S. Rhodesia). Verwey 1971 (to Gona re Zhou).

'Rhodesia' only: Fitzsimons 1920: 214. Haagner 1920: 126. Lavauden 1932.

Records: Baines 1864: 205 (R. Zambesi). Bulphin 1955: 81 (R. Lundi). Child 1968: 52 (Lake Kariba). Child & Savory 1964: 5 (Zambesi and Sabi valleys). Chubb 1909: 124 (Gwelo 1907). Cooke 1964: 18, fig. 7 (rock painting). Kerr 1887: 102, 259, 280, 290 (Mashonaland). Kirby in Bryden 1899: 38. Malcolmson 1952: 353 (Wankie N.P.). Nicolls & Eglinton 1892: 63 (Mashonaland, Matabeleland). Roth 1965 (Kariba, Operation Noah 1959-63). Roth & Child 1968 (Lake Kariba). Selous 1876: 179 (Tamusanka, R. Gwai), 1893: 438 (Mashonaland), 1907: 70, 102, 345 (R. Gwai), 1908: 188, 189 (N.E. Matabeleland 1878, R. Umfuli 1886). Shelton 1961: 77 (Zambesi valley).

6.9.26 Prehistoric occurrence

Guérin 1976 (fossil from Shungura formation, Lower Omo basin), 1979: 284 (list of fossil occurrences), 1980: 165-167, 171 (review). Hooijer 1973: 158, 166 (modern *D. bicornis* 4 million years old; small differences in dentition). Hooijer & Singer 1960: 117-121 (Hopefield, South Africa; skulls not distinguishable from recent).

6.10 ECOLOGY AND BEHAVIOUR

6.10.1 Review and general reports

Comprehensive studies: Joubert & Eloff 1971 (field study). Laurie 1982: 332-337 (comparison with other species). Schenkel & Schenkel 1969b (field study).

General reports: Anon. 1963b, 1970g (radio in horn to check movements). Anderson & Hitchins 1971 (radio tracking techniques). Best & Raw 1975: 164. Brehm 1877: 520. Capello & Ivens 1886: 184-189. Gaerdes 1967. Goddard 1969a, c (census techniques). Gromier 1949: 7-96 (observations during rhino's first year).

Grzimek 1966 (shutting ear hole by muscle movement). Haltenorth & Trense 1956: 206. Hitchins 1971: 2-8 (study techniques, radio transmitter). Jones 1979: 240. Pécaud 1925: 75. von Schreber 1835: 339-341. Spinage 1962.

6.10.2 Activity pattern

Andersson 1856: 394. Babault 1949: 8. Baker 1872: 248. Dorst & Dandelot 1970: 168. Fitzsimons 1920: 215. Foa 1908: 410. Frame 1971: 694. Goddard 1967b: 136-140. Grobbelaar 1924: 173-176. Guggisberg 1966a: 45, 55. Haltenorth et al. 1979: 104. von Heuglin 1877, II: 93. Hitchins 1971: 11, 12. Jackson 1894: 258. Jeannin 1936: 33, 1951: 120. Joubert & Eloff 1971: 28-31. Kirby 1899: 337. Kirby in Bryden 1899: 38. Malbrant 1936: 24. Neumann in Bryden 1899: 45. Ritchie 1963: 56. Roosevelt & Heller 1915, II: 642. Schenkel & Lang 1969: 14. Schenkel & Schenkel 1969b: 50-54, 1969d: 761. Stevenson-Hamilton 1950: 47. Stott 1948. A.H. Straker in Bryden 1899: 49. Taberer 1959. Watson 1949: 186. Wilhelm 1950: 13. Willoughby 1889: 166. Wood 1851: 757.

6.10.3 Associations

Andersson 1856: 395. Ansell 1960a: 52. Babault 1949: 8. Baker 1872: 247. Berger 1910b: 343. Blandford 1870: 248. Bourgoin 1955: 64. Dorst & Dandelot 1970: 166, 168. Dugmore 1925: 261. Fitzsimons 1920: 214. Frame 1971: 693. Giebel 1855: 201. Goddard 1967b: 139, 142. Haagner 1920: 126. Haltenorth et al. 1979: 105. Hamilton & King 1969: 77. Jeannin 1936: 57. Kingdon 1979: 99. Klingel & Klingel 1966: 304. Lang 1920: 86. Lyell 1910: 22, 1912: 34. Malbrant 1936: 24. Neumann 1900: 556. Oberländer 1903: 259. Ritchie 1963: 57. Roosevelt & Heller 1915, II: 641. Roth & Child 1968: 221. Schenkel & Lang 1969: 19. Schenkel & Schenkel 1969b: 54. Schillings 1925: 109. Schinz 1824: 290. Spinage 1960: 98. Stigand 1909: 281. Swayne 1894: 332. Watson 1949: 186. van de Werken 1968: 210. Wilhelm 1933: 55, 1950: 13.

6.10.4 Defecation and urination

Babault 1949: 9. Goddard 1967b: 143. Guggisberg 1966a: 57. Joubert & Eloff 1971: 34-36. Kingdon 1979: 98. Kirby 1920: 235. Ritchie 1963: 57. Schenkel & Schenkel 1969b: 76-83 (ritualisation), 1969d: 761.

6.10.5 Dung heaps

Attwell 1948: 40. Baker 1890: 93. Chadwick 1930: 116. Dorst & Dandelot 1970: 168. Fitzsimons 1920: 216. Frame 1971: 698. Hutchinson & Ripley 1954: 179. Lang 1920: 86. Lönnberg 1912a: 120. Owen 1956: 30. Ripley 1958: 173. Roosevelt & Heller 1915, II: 642. Schillings 1925: 109. Stevenson-Hamilton 1950: 47. Stigand 1909: 281. Walker 1971. Watson 1949: 187. Wilhelm 1933: 55, 1950: 13.

6.10.6 Dung scattering

Attwell 1948: 40. Babault 1949: 9. Barrington 1803: 255. Drake-Brockman 1910: 106. Foa 1908: 411. Goddard 1973: 63. von Heuglin 1877, II: 95. Kirby in Bryden 1899: 39. Koenig 1953: 71. Leuthold 1977: 91. Levillant 1795, III: 59. Lönnberg 1912a: 120. Mattenklodt 1936b: 148. Neumann 1898: 250. Peel 1900: 298. Roosevelt & Heller 1915, II: 642. Schillings 1925: 109. Spinage 1960: 99. Stigand 1909: 281. Stockley 1948: 27. Wilhelm 1950: 13.

6.10.7 Food

Alexander 1838, II: 2. Andersson 1856: 391. Ansell 1960a: 52. Babault 1949: 8.

Baines 1864: 153. Baker 1890: 93. Blanford 1870: 247 (method). Bourgoïn 1955: 64. Brocklehurst 1931: 111. Campbell 1957 (standing on hind legs). Camper 1782: 176. Chadwick 1930: 97. Child 1968: 54. Crandall 1968: 507. Darling 1960: 91. Denyer 1962 (plants). Desmarest 1819: 244. Dixon 1966: 32. Dorst & Dandelot 1970: 168. Fitzsimons 1920: 214. Foa 1908: 410. Frame 1971: 694. Ghika 1898: 178. Giebel 1855: 201. Goddard 1968 (food, coprophagy), 1970b: 148-160, 1970d: 5-7. Gordon-Cumming 1850, 1: 249. Guérin 1980: 177. Guggisberg 1966a: 54. Haltenorth et al. 1979: 105. Hartmann 1868: 364. von Heuglin 1877, 11: 95. Hitchins 1962 (plants). Hobley 1912 (Euphorbia). Hutchinson & Ripley 1954: 179. Jackson 1894: 258. Jeannin 1951: 121. Jones 1979: 241. Joubert & Eloff 1971: 10-15, 20. Kingdon 1979: 93, 95. Kirby in Bryden 1899: 39. Kirk 1864: 655. Klingel & Klingel 1966: 305 (coprophagy). Leplac 1925: 47. Lönnberg 1912a: 120. Loose 1975: 29. Lyell 1910: 21, 1913: 163. Maydon 1932: 113. Mitchell 1966. Mohr 1950: 87 (coprophagy, difficulties when changing teeth). Mukinya 1973: 392, 1977 (comprehensive study). Nelson 1978: 764. Neumann 1898: 123. Neumann in Bryden 1899: 45. Owen 1956: 30. Potocki 1900: 106. Roosevelt & Heller 1915, 11: 643. Schenkel & Lang 1969: 5, 16. Schenkel & Schenkel 1969b: 13-15, 1969d: 760. Schinz 1824: 290. Smith 1838. Spinage 1960: 100. Stevenson-Hamilton 1950: 47. Stigand 1909: 280. Watson 1949: 186. Wilhelm 1933: 55, 1950: 13. von Wissmann 1901: 45. Wood 1851: 756. Zeuner 1934: 33.

6.10.8 *Habitat*

Ansell 1960a: 52. Blanford 1870: 247. Bourgoïn 1955: 63. Bennet 1914: 187. Burton 1962: 209. Chenu & Desmarest 1858: 9. Dorst & Dandelot 1970: 166. Drake-Brockman 1910: 106. Evans 1979: 29. Fitzsimons 1920: 214. Fonck 1924: 111. Frame 1980. Goddard 1970a: 115, 117-119, 1970b: 146-148, 1970d: 4. Guggisberg 1966a: 46, 53. Haager 1920: 126. Haltenorth et al. 1979: 104. Hartmann 1868: 364. Heck 1896: 1022. von Heuglin 1877, 11: 93. Hitchins 1971: 11. Hobley 1922: 6. Hofmeyr 1975: 128. Hofmeyr et al. 1975: 36. Jeannin 1951: 120. Johnston 1886: 393 (bush). Joubert & Eloff 1971: 7-10. Kingdon 1979: 93. Kirk 1864: 655. Lönnberg 1912a: 120. Lyell 1912: 34. Malbrant 1936: 24. Mukinya 1973: 391-393. Neumann in Bryden 1899: 44. Oberländer 1903: 259. Ritchie 1963: 56. Roosevelt & Heller 1915, 11: 651. Roth & Child 1968: 217-220. Sayers 1930: 404. Schenkel & Lang 1969: 5. Schenkel & Schenkel 1969b: 13-22. Smithers & Tello 1976: 112. Stigand 1909: 280. Stott 1948. Swayne 1894: 322. Zeuner 1934: 33.

6.10.9 *Home range*

Child 1968: 53. Dorst & Dandelot 1970: 168. Frame 1971: 685, 698, 1980: 160. Goddard 1967b, 1973: 60. Haltenorth et al. 1979: 104. Hamilton & King 1969: 77. Hitchins 1969, 1971: 10. Joubert & Eloff 1971: 22-24. Kingdon 1979: 98. Klingel & Klingel 1966: 305. Leuthold 1977: 46. Mattenklodt 1936b: 149. Mukinya 1973: 396-398. Schenkel & Lang 1969: 14.

6.10.10 *Use of horn*

Allamand 1781. Joubert & Eloff 1971: 34 (rubbing). Ritchie 1963: 61. Schenkel & Lang 1969: 18 (rubbing). Spinage 1960: 96. Stigand 1909: 282. Swayne 1894: 322.

6.10.11 *Learning and memory*

Fasnacht 1974 (visual learning), 1977 (memory and habituation to optical food selection). McCain & Stepter 1968 (discrimination learning and extinction in

experiments with zoo animals).

6.10.12 *Licking with tongue*

Brick 1960: 127 ('can completely skin the area it licks in a single stroke').

6.10.13 *Longevity*

Crandall 1968: 513 (captivity). Goddard 1970a: 112. Guggisberg 1966a: 69. Haltenorth et al. 1979: 105. Hofmeyr et al. 1975: 38. Klös & Frese 1981b: 13, 15. Mentis 1972: 9. Mitchell 1911a: 453 (captivity, 271 months). Reynolds 1963a: 101. Ritchie 1963: 55-56.

6.10.14 *Movements and paths*

Baker 1872: 248. Blanford 1870: 247. Dorst & Dandelot 1970: 168. Frame 1971: 698. Guggisberg 1966a: 45. Joubert & Eloff 1971: 36-40. Lönnberg 1912a: 120. Malbrant 1936: 24. Ritchie 1963: 56, 59. Schenkel 1966: 599. Schenkel & Lang 1969: 5, 14. Schenkel & Schenkel 1969d: 760-761. Swayne 1894: 322. Wilhelm 1933: 55.

6.10.15 *Play*

Anon. 1953b (with stones in zoo).

6.10.16 *Population structure*

Foster & Coc 1968: 417 (density, biomass). Frame 1980: 158-160, 162 (sex ratio, age structure, density). Goddard 1967b: 145, 1970a. Hall-Martin & Penzhorn 1977. Hitchins 1968a. Hofmeyr et al. 1975: 38 (sex ratio). Joubert & Eloff 1971: 42. Klingel & Klingel 1966: 303-305. Mentis 1970 (biomass), 1972: 9 (sex ratio). Mukinya 1973: 391, 395. Roth & Child 1968. Schenkel & Schenkel 1969b: 35-41. Western & Sindiyo 1972: 51.

6.10.17 *Relations with men*

Anon. 1953a. Andersson 1856: 392. Babault 1949: 8. Baker 1872: 246. Barrington 1803: 226. Bennet 1914: 185. Berger 1910b: 343. Blanford 1870: 248. Bryden 1889: 287. Burton 1962: 209. Camper 1782: 176. Carhou 1912: 67. Crandall 1968: 507. Delegorgue 1847: 421. Dorst & Dandelot 1970: 168. Eliot 1966: 266. Field 1958. Findlay 1903: 190-192. Fitzsimons 1920: 216. Foa 1908: 412. Fonck 1924: 111. Ghika 1898: 178. Gordon-Cumming 1850, 1: 249. Grogan & Sharp 1900: 348. Grzimek 1963: 190. Grzimek & Grzimek n.d.: 39. Guggisberg 1966a: 40. Haltenorth et al. 1979: 105. Hamilton & King 1969: 81. Heck 1896: 1022. von Heuglin 1877, 11: 94. Hobley 1922: 6. Jackson 1894: 251. Jeannin 1936: 34, 1951: 122. Johnston 1902, 1: 372. Kirby 1920: 231. Knochenhauer 1903: 260. Lang 1920: 86. Leakey & Leakey 1953: 48. Letscher 1911: 113. Lönnberg 1912a: 125. MacKenzie 1950. Malbrant 1936: 24. Maydon 1932: 113. Maxwell 1924: 91. Mukinya 1973: 395. Neumann 1898: 21, 121. Neumann in Bryden 1899: 46. Owen 1956: 27. Potter 1949: 128. Ritchie 1963: 59. Roosevelt & Heller 1915, 11: 645-650. Schenkel & Lang 1969: 9-13. Schenkel & Schenkel 1969b: 30. Schillings 1925: 114. Schinz 1824: 290. Selous n.d.: 188, 1908: 186. T. Smith 1965: 113ff. Steedman 1835, 1: 69. Steinhardt 1920: 42. Stevenson-Hamilton 1950: 47. Stigand 1909: 281. Stott 1948, 1963. Swanepoel 1955. Swayne 1894: 322. de Vos & Braeck 1980. Watson 1949: 186. van de Werken 1968: 207. Wilwerding 1945. Wood 1851: 756.

6.10.18 *Relations with other animals*

General: Eliot 1966: 267. Goddard 1967b: 141, 144 (predation), 1973: 59 (predation). Haltenorth et al. 1979: 105. Joubert & Eloff 1971: 15-19, 28 (competition), 48-49 (predation). Kingdon 1979: 103. Ritchie 1963: 60 (lion, elephant, buffalo). Roosevelt & Heller 1915, II: 641 (enemies). Roth & Child 1968: 221 (fights). Schenkel & Schenkel 1969b: 22-25 (enemies, symbiosis), 59-76 (behaviour when encountering other species); 1969d: 761 (aggression). Stott 1948 (enemies).

Birds, symbiosis: Alexander 1838, II: 3. Gromier 1934: 357. Guggisberg 1966a: 72. Hall-Martin & Penzhorn 1977: 155. Kirby in Bryden 1899: 40. Letscher 1911: 119. Schenkel & Lang 1969: 6-7. Schillings 1925: 107.

Crocodile: Guggisberg 1966a: 71. Hartmann 1971. Roosevelt & Heller 1915, II: 641. Selous 1908: 200-204.

Eland: Hall-Martin & Penzhorn 1977: 155.

Elephant: Anon. 1960a. Allamand 1781. Babault 1949: 9. Baker 1890: 90. Bax & Sheldrick 1963: 41 (food competition, Tsavo 1961). Chadwick 1930: 103. Darling 1960: 21 (dependance for making waterholes). Deleborgue 1847: 430. Duveen 1961. Frame 1971: 695. Glover & Sheldrick 1964: 36 (food competition, Tsavo 1961). Guggisberg 1966a: 70. Heath 1973. Jeffreys 1933. Koenig 1953: 66. Lyell 1913: 164. Mitchell 1966. Schenkel & Lang 1969: 8. Walker 1971. van de Werken 1968: 210.

Hippopotamus: Fonck 1924: 116. Guggisberg 1966a: 71.

Hyena: Frame & Goddard 1970.

Leopard: Chadwick 1930: 98.

Lion: Andersson 1861: 125. Frame 1971: 695. Grobbelaar 1924: 175. Grzimek 1963: 187. Guggisberg 1966a: 70. Hartmann 1971. Hofmeyr 1975: 128 (attacks subadults). Poles 1956. Schenkel & Lang 1969: 7. Watson 1949: 187.

Ostrich: Johnston 1902, I: 372.

Ungulates: Schenkel & Lang 1969: 7-8.

White rhino: Anon 1966b (fights). Deane 1960. Owen-Smith 1973: 655-658. Steele 1960.

6.10.19 *Salt licks*

Joubert & Eloff 1971: 20 (mineral needs). Mukinya 1977: 135. Schenkel & Lang 1969: 16.

6.10.20 *Senses*

Allamand 1781. Andersson 1856: 392. Babault 1949: 8. Barrow 1804, II: 125. Bennet 1914: 184. Berger 1910b: 343. Burchell 1824, II: 72. Crandall 1968: 507. Fasnacht 1974. Foa 1908: 412. Frame 1971: 698. Guggisberg 1966a: 38-40. Haltenorth et al. 1979: 104. Jeannin 1936: 33, 1951: 121. Kingdon 1979: 96. Koenig 1953: 59. Leplae 1925: 47. Malbrant 1936: 24. Roosevelt & Heller 1915, II: 644. Schenkel & Schenkel 1969d: 762. Schillings 1925: 108. Smith 1940, II: 66 (inability to see ahead). Stigand 1909: 281. Wood 1851: 757.

6.10.21 *Social relations*

Frame 1971: 693. Hall-Martin & Penzhorn 1977: 151-154 (aggression), 156 (reactions to dead animal). Joubert & Eloff 1971: 25-28. Leuthold 1977: 36, 127, 224. Schenkel & Lang 1969: 20-25. Schenkel & Schenkel 1969b: 54-88.

Communication: Goddard 1967b: 141, 143. Schenkel & Schenkel 1969d: 761.

Fights: Attwell 1948: 40. Chadwick 1930: 101. Guggisberg 1966a: 60-66.

Hamilton & King 1969: 81. Somerville 1979: 163. Swara & Hillman 1979: 26-27.

6.10.22 *Speed*

Babault 1949: 9. Crandall 1968: 507. Demmer 1966: 211. Dorst & Dandelot 1970: 168. Eblé 1950. Guggisberg 1966a: 45. Jeannin 1951: 121. Kingdon 1979: 96. Lane 1940: 416. M. Maxwell 1938. Mar. Maxwell 1924: 101. Meinertzhagen 1955: 114. Potter 1947: 385. Schenkel & Lang 1969: 16.

6.10.23 *Territory*

Goddard 1967b: 141. Grzimek 1963: 123. Guggisberg 1966a: 59, 1966c: 45. Hitchins 1971: 13. Hutchinson & Ripley 1954: 179. Joubert & Eloff 1971: 20-22. Owen-Smith 1971b: 294 (absent). Ripley 1958: 173. Schenkel 1966.

6.10.24 *Voice*

Allamand 1781. Baker 1872: 247. Bryden 1899: 38. Chadwick 1930: 95. Dorst & Dandelot 1970: 168. Dubois 1852: 211. Frame 1971: 699. Frame & Goddard 1970. Goddard 1967b: 141, 143. Guggisberg 1966a: 68. Haltenorth et al. 1979: 104. Jeannin 1936: 34, 1951: 121. Kingdon 1979: 97. Neumann 1898: 123. Rapsch 1964. Ritchie 1963: 57, 59. Roosevelt & Heller 1915, II: 645. Selous n. d.: 188. van de Werken 1968: 211. Wilhelm 1950: 13.

6.10.25 *Wallowing and bathing*

Alexander 1838, I: 299. Barrington 1803: 259. Child 1968: 52 (swimming). Condy 1964: 31 (swimming). Frame 1971: 694. Grzimek 1963: 121 (swimming). Guggisberg 1966a: 57. Hall-Martin & Penzhorn 1977: 156 (swimming). von Heuglin 1877, II: 93. Joubert & Eloff 1971: 31. Kingdon 1979: 95. Lyell 1913: 164. Maydon 1932: 115. Roosevelt & Heller 1915, II: 641. Roth 1969: 15-17 (swimming). Schenkel & Lang 1969: 16. Schenkel & Schenkel 1969d: 761. Stigand 1909: 281. Watson 1949: 186. von Wissmann 1901: 45.

6.10.26 *Weapons*

Pitman 1956 (horn). Spinage 1960: 95, 98 (horn, teeth).

6.11 REPRODUCTION

6.11.1 *General studies*

Camper 1782: 171, 174. Dittrich 1965, 1967. Goddard 1966 (field work). Greed 1967. Hall-Martin & Penzhorn 1977: 152-160. Hallstrom 1967. Haltenorth et al. 1979: 105. Jarvis 1967. Jones 1979: 242-243 (review on breeding in zoos). Klös & Frese 1981b: 12-17 (statistics). Krishna Gowda 1967. Leakey & Leakey 1953: 50 (monogamy). Yamamoto 1967.

6.11.2 *Age at sexual maturity*

Crandall 1968: 513. Frädriich & Frädriich 1973: 190. Frame 1971: 699. Goddard 1967b: 146, 1970a. Kingdon 1979: 103. Klös & Frädriich 1970: 232. Klös & Frese 1981b: 19. Mentis 1972: 8. Reuther 1972. Ritchie 1963: 55. Roth & Child 1968: 222. Schenkel & Schenkel 1969b: 41-43.

6.11.3 *Artificial insemination*

Young 1965b, 1967 (semen collection techniques).

6.11.4 *Birth*

Faust 1958. Grzimek 1963: 187. Kingdon 1979: 102. Mentis 1972: 8. Schenkel & Lang 1969: 49.

6.11.5 *Calving interval*

Chadwick 1930: 107. Frame 1971: 699. Goddard 1967b: 146. Guggisberg 1966c: 40. Klös & Frese 1978. Mentis 1972: 8. Poles 1956: 249. Potter 1949: 128. Ritchie 1963: 55. Schenkel & Schenkel 1969b: 41. Stockley 1950: 89. van de Werken 1968: 209. Western & Sindiyo 1972: 51.

6.11.6 *Courtship and copulation*

Attwell 1948: 40. Dorst & Dandelot 1970: 168. Faust 1958. Frädrieh & Frädrieh 1973: 190. Frame 1971: 699. Fraser 1968: 102. Goddard 1967b: 147. Guggisberg 1966a: 60-66 (fights in courtship), 1966c: 42-45. Hays 1967. Hediger 1955. Joubert & Eloff 1971: 42. Kingdon 1979: 101. Leakey & Leakey 1953: 50. Leuthold 1977: 149, 152. Ritchie 1963: 57. Roth & Child 1968: 222. Schenkel & Lang 1969: 26, 49. Schenkel & Schenkel 1969b: 88-91. Seki 1966. Stockley 1948: 27. van de Werken 1968: 206. Wilhelm 1933: 55, 1950: 13.

6.11.7 *Gestation*

Asdell 1964: 535. Burton 1962: 209. Crandall 1968: 512. Frädrieh & Frädrieh 1973: 190. Frame 1971: 699. Goddard 1967b: 146, 1970a, 1973: 60. Gouveia 1969. Guggisberg 1966a: 67. Hays 1967. Jeannin 1936: 34. Joubert & Eloff 1971: 40. Malbrant 1936: 24. Mentis 1972: 7. Miller 1967. Potter 1949: 128. Reuther 1972. Ritchie 1963: 55. Rookmaaker 1973b. Schenkel & Lang 1969: 26, 49. Schinz 1824: 6. Seki 1966. Stevenson-Hamilton 1955: 47. Stockley 1948: 27, 1950: 89. Watson 1949: 187. Western & Sindiyo 1972: 51. Wilhelm 1933: 55, 1950: 13.

6.11.8 *Handrearing*

Anon. 1965b. Kearney & Vyvyan 1965. Krag 1966: 87. Sheldrick 1967.

6.11.9 *Mating season*

Ansell 1960a: 53, 1960b: 254. Asdell 1964: 535. Attwell 1948: 40. Bourquin et al. 1971: 34. Burton 1962: 209. Frame 1980: 160. Jeannin 1936: 34. Kingdon 1979: 101. Kirby 1899: 337. Kirby in Bryden 1899: 39. Klös & Frese 1978, 1981b: 14. Malbrant 1936: 24. Ripley 1958: 173. Roosevelt & Heller 1915, II: 641. Schulz 1961: 57. Stockley 1950: 89. Wilhelm 1933: 55.

6.11.10 *Milk composition*

Greed 1961. Gregory et al. 1965. Grzimek 1959, 1960b. Nelson 1978: 765.

6.11.11 *Mother's behaviour to child*

Baker 1890: 105. Chadwick 1930. Fitzsimons 1920: 217. Goddard 1973: 58. Guggisberg 1966a: 67-68. Joubert & Eloff 1971: 26. Kamei 1970. Kingdon 1979: 102. Miller 1967. Poles 1956: 249. Potter 1949: 128. Schenkel & Lang 1969: 27-29. Schenkel & Schenkel 1969b: 91-95, 1969d: 761.

6.12 PARASITES

6.12.1 *Review*

Ezzat 1945: 12, 75-104 (nematodes 13 species; Habronema khalili n. sp.).

Guggisberg 1966a: 73 (list of ticks). Joubert & Eloff 1971: 49. Kingdon 1979: 103. Lang 1976: 166-167 (zoo animals). Schenkel & Schenkel 1969b: 28-30 (endo-and ectoparasites). Silberman & Fulton 1979: 9 (zoo animals). Wilhelm 1933: 55, 1950: 14. Zumpt 1964, 1965.

6.12.2 *Records*

Bänziger 1975 (*Calpe eustrigata*—Lepidoptera, Noctuidae, in zoo Kuala Lumpur). Baker & Keep 1970: 41 (Zululand, ticks). Brocklesby 1967 (*Babesia*, 2 species). Brocklesby & Vidler 1965: 121 (*Babesia*, *Theileria*, *Trypanosoma*). Buisson 1923: 210, 212, 214, 216, 217, 243 (Ethiopia, infusorians in intestines). Cerný 1958 (*Amblyomma gemma* and *A. marmoreum*). Clausen & Ashford 1980 (bacterial infections, pathogenic *Streptococcus* and *Staphylococcus*). Cobbold 1879: 401 (*Gastrophilus rhinocerotis*). Dekeyser 1955: 317 (*Oxyuris karamoja*). Fitzsimons 1962 (*Parabronema roundi*, intestine or stomach). Glover & Sheldrick 1964: 36 (*Microfilaria*). Griffith 1939: 1408 (bovine bacille responsible for tuberculosis, species not mentioned). Keep 1970: 54 (*Babesia* in blood). Keep & Basson 1973 (nematodes, cestodes, dipterous larvae). Khalil 1927 (*Parabronema rhinocerotis* from intestine). Lyell 1913: 164 (maggots in flesh). Neitz 1965: 313 (*Oxyuris equi*, Nematelminthes). Neumann 1899: 214, 263 (*Amblyomma crenatum*, *A. sublateum*), 1901: 297 (*Amblyomma crenatum*). Neveu-Lemaire 1924a (*Strongylinae* species in stomach), 1924b (*Khalilia rhinocerotis*), 1925a (*Quilonia parva*), 1925b (*Pteridopharynx omoensis*). Parsons & Sheldrick 1964 (biting flies *Lyperosia* sp., *Rhinomusca* sp. Kenya). Peters 1856 (*Taenia gigantea*, intestines, Mozambique), 1871 (*Taenia gigantea*). Rodhain & Bequaert 1918: 444 (*Gyrostigma conjungens*, *G. meruensis*, *G. pavesii*). Roosevelt & Heller 1915, II: 643 (biting flies, ticks). Round 1962 (*Strongylus (Dicerocola) tremletti*, colon), 1964 (*Stephanofilaria dinniki*). Sachs & Sachs 1968: 466 (nematode eggs in faeces). Schillings 1925: 109 (*Amblyomma*, Dermacator). Schulze 1919: 191 (*Hyalomma*). Teuscher & Stünzi 1956: 266 (*Strongylids* in dung). Thapar 1924 (6 new species of *Kiluluma-Strongylidae*, nematodes), 1925 (4 new species of *Kiluluma*). Tremlett 1964 (*Stephanofilaria*). Warnecke & Göltenboth 1977 (*Gyrostigma conjungens* in dung). Zumpt 1962 (*Gyrostigma pavesii*, *G. conjungens*).

6.13 VETERINARY STUDIES

6.13.1 *Review*

Jones 1979: 246-250. Silberman & Fulton 1979.

6.13.2 *Records*

Anon. 1891 (cancer in stomach), 1981a (Brookfield zoo, cracks in toenail). Boever 1976 (interdigital corns). Clausen 1981 (trypanomiasis). Deane 1962a (observations on injured rhino). Fiennes 1966: 372 (London zoo, mitral stenosis—bronchitis). Grünberg & Burtcher 1968 (pock-like skin disease and cutaneous mucous membrane). Gush 1964 (snare wound). Harthoorn 1966 (chronic endocarditis). Hungerford et al. 1967: 357 (Philadelphia zoo, pulmonary abscess). Keep & Basson 1973 (lameness due to *Mycobacterium* infection). Klöppel 1956 (Frankfurt zoo, *volvulus jejuni*). Klös & Frädrieh 1970: 233 (causes of death in zoo animals). Klös & Frese 1981b: 18 (causes of death in zoo animals). Kolb 1958: 381 (discovery of gravidity). Krag 1966 (uterine prolapse). Lang 1976: 166-171 (review of diseases in zoo animals). McCulloch & Achard 1969 (causes of death). McCulloch et al. 1969:

141 (disease symptoms). Mayr & Mahnel 1970 (chickenpox virus). Mugerá & Wandera 1967 (polymyopathy). Nelson 1978: 766 (zoo animals). Pearson et al. 1967 (rectal prolapse). Pocock 1912 (broncho-pneumonia). Schenkel & Schenkel 1969b: 26 (diseases during drought). Shepstone 1931: 36 (New York zoo, abscess left jaw). Takagi et al. 1964 (tuberculosis). de Vos 1980 (possible botulism). de Vos & Braack 1980 (castration). van de Werken 1966b: 27 (eye disease). Windsor & Ashford 1972 (liver infected by *Salmonella typhimurium*). Zeller 1963 (Cologne zoo, tuberculosis). Zukowsky 1965: 157 (rachitis).

6.13.3 Sores on body

Attwell 1948: 37 (unction). Clausen & Ashford 1980. Glover & Sheldrick 1964: 36. Guggisberg 1966a: 73. Hitchins & Keep 1970. Lang 1976: 166. Potter 1947: 385 (due to sexual activity). Ritchie 1963: 60 (rubbing). Schenkel & Schenkel 1969b: 27 (biting flies). Schulz 1961. Schulz & Kluge 1960 (filarids). Spinage 1960: 100. Stigand 1909: 282 (friction with vegetation and ticks). Stockley 1948: 27, 1950: 89. Tremlett 1964. Willoughby 1889: 128. Wilson & Edwards 1965: 179 (on throat). Young 1966 (treatment of granulomata). Zukowsky 1966.

6.14 IMMOBILISATION AND TRANSLOCATION

Anon. 1970g (anaesthesia), 1971a (drugs, methods). Brooks 1967: 17 (capture). Carter 1965. Condy 1964 (reactions to drugs, capture), 1966 (drugs). Ebedes 1966, 1967 (drugs, techniques). Haigh 1977 (drugs, methods, results). Hall-Martin & Penzhorn 1977 (behaviour). Harthoorn 1961: 305 (drugs, effects), 1965: 58-65 (drugs, methods), 1966 (drugs), 1968: 219 (drugs, techniques), 1976: 195, 200-202 (drugs, techniques). Hitchins et al. 1972 (drugs, methods). Hofmeyr & de Bruine 1973 (methods). Hofmeyr et al. 1975 (capture, techniques, immobilisation). Jones 1966 (drugs, techniques). D. Jones 1979: 244-245 (restraint in zoos). Keep et al. 1969 (reactions to drugs). King 1969 (drugs, techniques). King & Carter 1965 (effects of drugs). Lang 1976: 165 (drugs in zoos). McCulloch & Achard 1969 (drugs, management, mortality). Nelson 1978: 765 (restraint in zoos). Pearson et al. 1967 (immobilisation of 4 months old calf). Roth 1965 (methods).

6.15 MUSEUM SPECIMENS

General: Ansell 1978: 50. Best & Raw 1975: 489-492 (former and present owners of record horns). Rookmaaker & Groves 1978: 118 (specimens of *D. b. bicornis*). Zukowsky 1965: tables between pp. 152-153 and *passim* (examined specimens). *Albany*, Museum: Shortridge 1934: 415. *Berlin*, Zoologisches Museum: Brauer 1910: 389 (embryo, Tanzania). *Calcutta*, Asiatic Society: Blyth 1863b: 138 (anterior horns). *Calcutta*, Indian museum: W. Sclater 1891: 205 (horns). *Cape Town*, South African museum: Layard 1861: 61 (head). *Cracow*, Polish Academy of Sciences: Kubiak & Dziurdzik 1973: 56 (mounted head). *Exeter*, Royal Albert Memorial museum: Howes & Bamber 1970: 327. *Frankfurt a. M.*, Senckenberg museum: Schwarz 1920: 867 (5 specimens from Adolf Herzog zu Mecklenburg). *Groningen*, University: A. Camper 1809: 80, 1811: 19 (museum Petrus Camper, nos. 64-66). Vrolik 1830 (1 skull). *Haarlem*, Hollandsche Maatschappij van wetenschappen: van Marum 1803: xi (horns).

Hamburg, Zoologisches Museum: Noack 1891: 79 (horns). *Johannesburg*, Africana Museum: Andersson 1946 (mounted horn cup). *Kaffraria*, Museum: Shortridge 1934: 415. *Leeds*, Natural History museum: Falconer 1868, II: 403 (skull). *Leiden*, Rijksmuseum van Natuurlijke Historie: Jentink 1887: 167-168, 1892: 197. Loose 1975: 36. Vrolik 1830 (1 skeleton, 3 skulls). *Leiden*, W. Vrolik: Dusseau 1865: 174 (skeleton from Cape). *London*, British Museum (Natural History): Dollman 1921: 82. Gray 1843: 186, 1862: 282, 1868: 1025. Loose 1975: 36. Roosevelt & Heller 1915, II: 656. Setzer 1956: 570 (2 *D. b. somaliensis*). de Winton 1899 (from Nyasaland). *London*, East India Co. museum: Horsfield 1851: 196 (anterior horn). *London*, Royal College of Surgeons: Flower & Garson 1884 (nos. 2147-2153). Gray 1868: 1025. *Lüderitz* museum: Heinz 1933 (excavated skull). *Milano*, Natural History museum: de Beaux 1923: 287 (4 skulls, 1 foetus from Somalia, collected Zammarano 1916-22). *Oxford*, University Museum: Cave 1947: 146 (specimens collected by Burchell). *Paris*, Muséum National d'Histoire Naturelle: Cuvier 1822: 4, 1836b, pl. 54. Desmarest 1822 (skeleton from Cape collected Delalande, 1821). Kyou-Jouffroy 1971: 272 (skeleton). *Swakopmund*, Museum: Sauer 1972 (horn from Namibia). *Uppsala*, Royal Academy of Sciences: Sparrman 1977, II: 83 (horns). *Vienna*, Zoologisches Museum: Toldt 1914: 268 (foetus). *Washington*, United States National museum: Hollister 1924: 135 (33 skulls E. Africa, 7 skulls Kenya). Roosevelt & Heller 1915, II: 656. True 1893: 479.

6.16 EXHIBITION IN CAPTIVITY

6.16.1 Review

Klös & Frädrieh 1970 (studbook 31.12.1968), 1971 (studbook I.11.1971). Klös & Frese 1977 (studbook 31.12.1976), 1978 (studbook, statistics), 1981b (studbook 31.12.1980, statistics). Kourist 1973. Reuther 1972 (list of births 1941-1971). Reynolds 1963a (retrospective list of all specimens; list of births on p. 102). Rookmaaker 1973b (list of births 1941-1972). Census of rare animals, International Zoo Yearbook 6: 446, 7: 372, 8: 367, 9: 291, 10: 323, 11: 334, 12: 392, 13: 372, 14: 422, 15: 422, 16: 438, 17: 364, 18: 435, 19: 415, 20: 477, 21: 361. Species of wild animals bred in captivity, International Zoo Yearbook 9: 233, 10: 268, 11: 279, 12: 333, 13: 336, 14: 385, 15: 380, 16: 399, 17: 322, 18: 392, 19: 370, 20: 438, 21: 325.

6.16.2 American circuses

Flint 1970: 7 (Boston Zoological Institute, 1835, expecting two-horned rhino). Murray 1956 (Bailey, Australian tour 1876). Reynolds 1963a: 100, 1967a: 290 (Ringling Bros., 1894), 1968a (review), 1976 (Ringling-Barnum, different specimens), 1982 (Ringling Bros. & Barnum & Bailey, 1929-35, 1931-33, 1934-35, 1945-53). Thétard 1947: 185 (Barnum).

6.16.3 European travelling menageries

Brick 1960: 127 (Novacek and Richter, tour through Egypt and Far East, species unidentified). Gleiss 1967: 42, 241 (Breslau, from Nubian caravan, 1878). Heck 1896: 1021 (Hagenbeck's Nubian caravan in Berlin). Schneider 1930: 23 (Christoph

Schulz, import 1929). Zukowsky 1954: 10 (Schulz, imported 3 rhinos).

6.16.4 Zoological gardens

- Amsterdam*: Jacobi 1959 (arr. 1937, 1948). Portielje 1940: 43 (arr. 1937). Zukowsky 1965, fig. 24.
- Antwerp*: Gijzen 1960: 16 (arr. 1858). Kourist 1973: 137 (arr. 1858?)
- Atlanta*: Reynolds 1968b (arr. 1967).
- Bangkok*: Gorgas 1970: 103 (one present).
- Berlin East*: Petzold 1961: 70 (arr. 1956), 1965: 68 (arr. 1961). Zukowsky 1965: 106 (arr. 1958 pair).
- Berlin West*: Anon. 1872: 319. Anon. 1931: 35 (one Sept. 1930). Flower 1908: 16 (2 present). Gaebler 1883b: 243 (one present). Heck 1930: 71-76 (arr. 1929). Klös 1961a: 129 (arr. 1957), 1969a: 78 (in 1878). Knauer 1914: 130 (one present). Knottnerus-Meyer 1905: 109 (arr. 1905). Kourist 1973: 137 (in 1870). Noll 1873: 141 (arr. 1870), 1876: 336 (one present). Schlawe 1969: 28 (1870-1887, 1878). Slater 1872c: 428 (ca. 1870). Steinmetz 1940: 342 (arr. 1940), 1942: 283 (died 1941). Zukowsky 1965: 1, 106, 130, 139, 109 (1870-1884, 1903-1908, 1907-1917, 1928-1943, arr. 1960).
- Breslau*: Gilciss 1967: 42, 241 (1888-1892, arr. 1907, 1932). Kourist 1973: 137, 139 (arr. 1888).
- Bristol*: Anon. 1964b (birth 1964). Aschaffenburg et al. 1961 (birth 1958). Greed 1967 (births 1958, 1961, 1964, arr. 1962). Gregory et al. 1965 (birth 1961). Pearson et al. 1967 (birth 1964).
- Chester*: Anon. 1970c, 1971b (birth 1971), 1973c (birth 1973).
- Chicago Brookfield*: Anon. 1981a. Bean 1941 (birth 1941). Hediger 1955 (birth 1941). R. 1958 (birth 1941). Reynolds 1982 (birth 1944).
- Cincinnati*: Maruska 1964 (arr. 1960, 1961, 1964). Reynolds 1961c (birth 1961).
- Cologne*: Kohle 1981: 105 (arr. 1908). Zeller 1963 (died 1957).
- Colombo*: Schmidt 1970: 121 (birth 1968).
- Denver*: Freiheit 1971 (birth 1971).
- Detroit*: Anon. 1965b (arr. 1957, birth 1964). Kreag 1966 (birth 1964).
- Dresden*: Anon. 1929: 450 (arr. 1928), 1930b: 353 (arr. 1928). Sailer 1941: 15 (one present). Zukowsky 1965: 157, fig. 78 (1920's, 2 in 1927).
- Dublin*: Anon. 1969b (birth 1969). van Bommel 1962 (arr. 1962), 1963b (2 present).
- Dvur Kralove*: Vagner 1980.
- Frankfurt am Main*: de Beaux 1912: 565 (arr. 1909). bs. 1970 (birth 1969). Faust 1958 (arr. 1950, 1952, birth 1956), 1964a (birth 1956 to La Plata 1959), 1964b (birth 1958). Klöppel 1956 (died 1952). Priemel 1930: 352 (arr. 1927). R. 1958 (birth 1956). Zukowsky 1965: 130 (arr. 1960).
- Fresno*: Reynolds 1964a (arr. 1963).
- Hamburg*: Kourist 1969b: 10 (arr. 1881), 1973: 137 (arr. 1881). Sigel 1881: 361 (one deposited).
- Hamburg* (Hagenbeck): de Beaux 1912: 561 (2 arr. 1910/11). Hagenbeck 1928: 35, 41, 81, 150 (arr. 1871). Mitchell 1911c, d (pair present). Noack 1889: 107 (present 1887). Schulz 1921: 23, 25 (sent ca. 1918/19). Zukowsky 1954: 14 (present 1913, arr. 1922), 1965: 55, 81, 83, 96, fig. 39 (arr. 1914/16, 1920's, 3 arr. 1931, arr. 1929, present 1907).
- Hanover*: Anon. 1968h (birth 1968). Dittrich 1965 (birth 1965), 1967 (birth 1965), 1972 (birth 1970). Eiffert 1957: 257 (3 arr. 1954).
- Jacksonville*: Reynolds 1961 (arr. 1961).

- Kansas City*: Reynolds 1967b (arr. 1967).
- Kobe*: Kamei 1970 (birth 1969). Yamamoto 1967 (births 1963, 1965).
- Kuala Lumpur*: Bänziger 1975.
- Leipzig*: Schneider 1930: 23 (shown 1929).
- Lisbon*: Brouard 1978 (one in 1977). Florio 1973: 211 (showing pair and young). Gouveia 1969 (birth 1969). Zukowsky 1965: 68-69, figs. 29, 30, 32, 33 (no dates).
- London*: Anon. 1872: 319 (one present), 1891 (died 1891). Beddard & Murie 1891 (1868-1891). Brightwell 1948: 31. Fiennes 1966: 372 (died 1964). Flower 1908: 27, 1931: 203 (1868-1891, 1911-1924). Hindle 1947b: 794 (arr. 1947). Kourist 1973: 137 (arr. 1868). Loisel 1907: 16 (one present). Mitchell 1906 (arr. 1906), 1911b (arr. 1911), 1923: 175 (arr. 1922), 1928: 1036 (arr. 1928). Noll 1873: 141 (arr. 1868). Pocock 1912 (1906-1912), 1928a (arr. 1928). Reynolds 1963a: 99 (1868-1891). Scherren 1905: 140, 215 (arr. 1868, 1879). Slater 1868 (arr. 1868), 1870 (arr. 1868), 1872c: 428 (arr. 1868), 1876a: 655 (arr. 1868). Zukowsky 1965: 136-138, fig. 67 (1868-1891).
- Memphis*: Reynolds 1965a (arr. 1958, 1964), 1976 (1958-1966).
- Moscow*: Anon. 1970c (arr. 1970).
- Mysore*: Krishna Gowda 1967 (birth 1966). Miller 1967 (birth 1966).
- Naples*: Florio 1976 (birth 1975).
- New York*: Lang 1920: 86 (arr. 1907). Shepstone 1931: 36. Zukowsky 1965: 84 (1932-1941).
- Oklahoma City*: Anon. 1968b (birth 1968). Reynolds 1964a (arr. 1963).
- Osaka*: Takagi et al. 1964: 125 (1955-1961).
- Paris*: P. Slater 1891: 327.
- Peking*: Jarvis 1966: 454 (2 present).
- Pittsburgh*: Hays 1967 (births 1963, 1965). Reynolds 1961d (birth 1960), 1963b (birth 1963), 1964a (birth 1963), 1965b (birth 1965).
- Pretoria*: Bigalke 1946: 325 (1914-1942). Haagner 1920: 127. Zukowsky 1965: 60 (arr. 1958).
- Rio de Janeiro*: Hediger 1955 (birth 1954). R. 1958 (birth).
- Rome*: Zukowsky 1965: 96-97, fig. 47 (1910-1915).
- Rotterdam*: van Bommel 1960 (birth 1960), 1962 (departure 1960). Coomans de Ruiter 1957 (arr. 1940). Kuiper & Schneider 1940 (one present).
- Saanane Island, Tanzania*: Achard & McCulloch 1967. McCulloch et al. 1969: 141 (arr. 1964).
- San Diego*: Anon. 1952 (arr. 1952), 1953a, b, c, 1958a, 1976c (birth 1976). Bode 1952 (arr. 1952). Dolan & Moran 1969: 61 (arr. 1952). Glenn 1954. Pournelle 1969 (arr. 1969).
- San Francisco*: Reuther 1972 (birth 1972).
- Sydney*: Hallstrom 1967 (births).
- Tokyo*: Nishiyama 1961, 1964 (one died). Seki 1966 (birth). Sotani 1974.
- Vienna*: Antonius 1931: 260 (arr. 1931). Grünberg & Burtscher 1968: 649 (1942-1967).
- Washington*: McCrane 1967 (arr. 1967). Reed 1968: 403 (birth 1967), 1969: 264 (birth 1967). Reynolds 1967b (arr. 1967).
- Whipsnade*: Anon. 1970c.
- Zagreb*: Klimek 1971 (birth 1970).

CHAPTER 7

THE SUMATRAN RHINOCEROS, DICERORHINUS SUMATRENSIS

7.1 REVIEW

Borner 1979a. Groves & Kurt 1972. Hubback 1939a, b. van Strien 1974a. Talbot 1960.

7.2 TAXONOMY AND NOMENCLATURE

7.2.1 Revisions

Gray 1872, 1873a, b (*Ceratorhinus sumatranus* of Sumatra identical with *C. lasiotis* of Chittagong; Malayan form is distinct and known as *C. crossii* in 1872 and *C. niger* in 1873; *C. blythii* in Tenasserim). Groves 1965 (*D.s. sumatrensis*: Sumatra; *D.s. niger*: Malaya; *D.s. lasiotis*: Tenasserim and northwards; *D.s. harrissoni*: Borneo), 1967a: 230 (*D.s. sumatrensis*: Sumatra, Malaya; *D.s. harrissoni*: Borneo; *D.s. lasiotis*: Burma, India). Groves & Kurt 1972 (as Groves 1967a). Harper 1945: 390-395 (*D.s. sumatrensis*: Sumatra, Borneo; *D.s. niger*: Malaya; *D.s. lasiotis*: mainland). Sclater 1872a, b, d, g, 1873a (*R. sumatrensis*: Sumatra, Malaya; *R. lasiotis*: Chittagong).

7.2.2 Remarks

Ansell 1947: 266 (pigmy rhino in Salween dt., Burma). Bell 1793 (animal found 10 miles from Fort Marlborough, Sumatra - cf. Guggisberg 1966a: 106, Jardine 1836: 177). Flower 1878 (skull from Comilla; uncertain if differences to be considered of specific value). Guérin 1980: 172-174 (differences between subspecies). Hubback 1939a: 596 (review). Prater 1939: 618-620 (review). van Strien 1974a: 6-8 (review).

7.2.3. Subspecies and synonyms of *Dicerorhinus sumatrensis*

Ceratorhinus blythii Gray, 1873a: 360, proposed provisionally.

Type-specimen: Young skulls figured by Blyth 1862a, pl. 3 figs. 2, 3 (not fig. 1 which is '*R. crossii*') after specimens in the Museum of the Asiatic Society of Bengal, Calcutta.

Type-locality: Tenasserim.

Remarks: Chasen 1940 (name *blythii* available for Malayan form if it is distinct).

Dollman 1928: 257 (in Malaya, Tenasserim).

Taxon considered valid:

Ceratorhinus blythii Gray 1873a.

Rhinoceros (Dicerorhinus) sumatrensis blythii; Lydekker 1916.

Rhinoceros borniense Hose & McDougall, (1912) 1966: 3.

Type-specimen: not designated.

Type-locality: Borneo.

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Remark: Rookmaaker 1977c: 54 (nomen nudum because there is no description or picture).

Taxon considered valid:

Rhinoceros borniense Hose & McDougall (1912) 1966.

Rhinoceros crossii Gray, 1854.

Type-specimen: British Museum (Natural History), no. 1854. 12.8.1, anterior horn of 3'5" along the curve length, from collection of Mr. Cross (figured by Groves 1971, fig. 16).

Type-locality: unknown.

Remarks: Blyth 1861 (*R. crossii* synonymous with *R. sumatranus* as similar horns belonging to that species were observed), 1862a: 156 (*R. crossii* has a near affinity to *R. sumatranus*), 1863a: 156 (*R. crossii* referable to *R. sumatrensis*), 1872a: 400 (*R. crossii* is *R. lasiotis*), 1875: 51 (*R. crossii* used as synonym of *R. lasiotis* living in Chittagong, Burma and Assam). Brandt 1878a: 44 (*R. crossii* is *R. sumatrensis*, not *R. lasiotis*). Fyfe 1878: 103 (*R. crossii* and *R. sumatrensis* in Burma). Gray 1868: 1022 (*R. crossii* referred to *R. sumatranus*, cf. Blyth), 1873a: 359 (*R. crossii* may be identical to the Tenasserim or Malaya or Sumatra form of *R. sumatranus*). Sclater 1862 (*R. crossii* is *R. sumatrensis*, cf. Blyth).

Taxon considered valid:

Ceratorhinus crossii; Gray 1872, 1873a. - Blyth 1875.

Rhinoceros crossii Gray 1854. - Gray 1862.

Didermoceros sumatrensis harrissoni Groves, 1965: 128.

Type-specimen: British Museum (Natural History), no. 1901.8.15.1, almost adult female skull.

Type-locality: Suan-Lambah, Sabah, Borneo.

Remarks: Blyth 1875: 53 (in Borneo there would appear to be a still smaller species).

Flower 1876 (skull from Borneo identified as *R. sumatrensis*). Harrisson 1965b: xix (early reaction).

Taxon considered valid:

Dicerorhinus sumatrensis harrissoni; Groves 1967a. - Groves & Kurt 1972. Guérin 1980. Harrisson 1975. Rookmaaker 1977 c, d. van Strien 1974a.

Didermoceros sumatrensis harrissoni Groves 1965. - Harrisson 1965b. Medway 1965a, 1977.

Rhinoceros lasiotis Buckland, 1872.

Type-specimen: Animal captured in Chittagong in 1867 (Hood 1869, Manson 1876), lived in the London zoo 14 Feb. 1872-31 August 1900, kept in British Museum (Natural History).

Type-locality: Sungoo river, Chittagong (Bangladesh).

Authorship: The name was often attributed to P.L. Sclater. Sclater was responsible for the name and the reasons of distinction, but Buckland (1872) published his note as early as 10 August 1872 stating that *R. lasiotis* 'has been named by Dr. Sclater' (see Harper 1940: 201). Sclater distinguished the species after comparing the type-specimen and a rhino from Malacca deposited in the London zoo by William Jamrach in July 1872 and purchased by the Society on 2 August 1872 (Sclater 1872c, f, g). He proposed to call the Chittagong animal *R. lasiotis* 'in a paper read before section D at the British Association's meeting at Brighton on the 16th of August' (Sclater 1872a), or 6 days after the appearance of Buckland's

- note. The proceedings of the Brighton meeting were reported first in the *Times* (19 August 1872, p.5 - not seen) and the *Athenaeum* of 24 August 1872 (Sclater 1872b) and later more officially (Sclater 1872b, 1873a).
- Remarks: Blanford 1891 (variety only). Brandt 1878a: 44 (in India). Chasen 1940 (in Chittagong). Heck 1896: 1020 ('Spielart'). Hooijer 1946a: 27-29 (no right of distinction from *D. sumatrensis*). Krumbiegel 1960 (on mainland). Lydekker 1881:56, 1892a, 1893: 382 (mere variety). Neuville 1927: 182 ('race locale'). Sclater 1876a: 652-654 (differences from *R. sumatrensis*). Sody 1946 (*R. lasiotis* distinct, against Hooijer 1946a).
- Taxon considered valid:
- Ceratorhinus lasiotis*; Gray 1873b. - Brandt 1878a, b, c, 1879. Flower 1876. Garrod 1873.
- Dicerorhinus lasiotus*; Sody 1946.
- Dicerorhinus sumatraensis lasiotis*; Krumbiegel 1960.
- Dicerorhinus sumatrensis lasiotis*; Harper 1940. - Brentjes 1978. Chasen 1940. Groves 1967a. Groves & Kurt 1972. Guérin 1980. Guggisberg 1966a. Harper 1945. van Strien 1974a.
- Didermoceros sumatraensis lasiotis*; Reynolds 1961a.
- Didermoceros sumatraensis lasiotis*; Maliepaard & de Vos 1961.
- Didermoceros sumatrensis lasiotis*; Grassé 1955. - Crandall 1968. Deuve & Deuve 1964. Groves 1965. Kourist 1973. Prater 1965. Ulmer 1958.
- Rhinoceros lasiotis* Buckland 1872. - Anderson 1883. Baker 1887. Blyth 1872a. Brehm 1877. Duncan 1892. Evans 1912. S. Flower 1908. W. Flower 1878. Friedel 1872b. Heck 1896. Lydekker 1881, 1883, 1893. Mason 1882. Neuville 1927. Newman 1872c, 1874. Noack 1886. Noll 1873. Sanyal 1892. Sclater 1872a, b, d, f, g, h, 1873a, 1876a, 1877, 1884, 1886b. W. Sclater 1891. Vogt 1884.
- Rhinoceros sumatranus lasiotis*; Hose 1893.
- Rhinoceros sumatrensis lasiotis*; Trouessart 1898. - Delacour 1940. Lydekker 1900, 1907a, 1925. Thomas 1901.
- Rhinoceros* (*Ceratorhinus*) *lasiotis*; Zittel 1891.
- Rhinoceros* (*Dicerorhinus*) *sumatrensis lasiotis*; Lydekker 1916. Gijzen 1960. Wroughton 1921.
- Rhinoceros vel Ceratorhinus (crossii?) lasiotis*; Sterndale 1884.
- Rhinoceros malayanus* Newman, 1874. Published without description. Newman mentioned 2 Asiatic species: *R. lasiotis* and *R. malayanus*, the latter possibly an error for *R. niger* Gray, 1873.
- Ceratorhinus niger* Gray, 1873a: 357, pl. 11.
- Type-specimen: British Museum (Natural History), no. 1872.12.31.1, complete specimen received from the Zoological Society of London where it lived 2 August 1872-21 September 1872. It was obtained by W. Jamrach in Singapore but caught in Malaya in 1871. Its anatomy was described by Garrod (1873).
- Type-locality: 'Malacca' (Gray 1873a), from Sunghi-njong dt. (Sclater 1876a), i.e. Sungei Ujong dt. Malaya, presently in western Negri Sembilan around Seremban.
- Taxon considered valid:
- Ceratorhinus niger* Gray 1873a. - Gray 1873b.
- Dicerorhinus sumatrensis niger*; Harper 1945.
- Didermoceros sumatrensis niger*; Talbot 1960. - Groves 1965. Medway 1969.

Rhinoceros sumatrensis niger; Lydekker 1907a.

Rhinoceros bicornis var. *sinensis* Laufer, 1914: 159. Introduced for the double-horned rhinoceros living in China (si).

Remark: Rookmaaker 1980b: 260 (a nomen nudum and preoccupied by *Rhinoceros sinensis* Owen, 1870).

Rhinoceros sumatranus Raffles, 1822: 268.

Type-specimen: not designated.

Type-locality: Sumatra.

Taxon considered valid:

Rhinoceros sumatranus Raffles 1822. - Banks 1935, 1978. de Blainville 1846. Blyth 1847a, 1861, 1862a, 1863a, b, 1872b. Boitard 1842. Brehm 1877. Cantor 1846. Carter et al. 1946. Gray 1862, 1868, 1869b, 1873a. Hagen 1881. Harrisson 1948. Hose 1893. Hose & McDougall 1966. Jardine 1836. Lesson 1838. Manson 1876. von Martens 1876. Mohnike 1883. Müller & Schlegel 1845. Murray 1866. Newman 1872a, c. Noack 1886. Oken 1838. Owen 1845. Pfeffer 1958. Pöppig 1851. von Rosenberg 1878. Schinz 1845. Schlegel 1857, 1872. von Schreber 1835. Sclater 1862. Snelleman 1887. Tate 1947. Vogt 1884. Waterhouse 1838.

Rhinoceros (*Ceratorhinus*) *sumatranus*; Banks 1931.

Rhinoceros sumatrensis G. Fischer, 1814: 301, with reference to Bell (1793) and Cuvier (1806).

Type-specimen: not designated.

Type-locality: Sumatra.

Remarks: Brandt 1878a: 42 (in Pegu, Siam, Malaya, Sumatra, Borneo). Cuvier 1812b. 1st pl.: 1836b, pl. 42 fig. 8 (skull copied from Bell). Dollman 1928: 257 (in Sumatra). Krumbiegel 1960 (in Sumatra, Borneo).

Taxon considered valid:

Ceratorhinus sumatrensis; Gray 1873b. - Blyth 1875. Brandt 1878a, b, c, 1879. Breuning 1924. Flower 1876, 1891. Forbes 1881. Garrod 1873, 1879. Hagen 1890. Jentink 1887, 1892, 1897. Patte 1934. Volz 1912.

Cerathorhinus sumatrensis; Jentink 1889.

Dicerorhinus sumatrensis; Gloger 1841. - Ansell 1947. Antonius 1937. Asdell 1964. Borner 1979a. Cave 1959. Chakraborty 1972. Chasen 1940. Christison 1945. Flynn 1978. Groves 1971. Grzimek 1958, 1960a. Guérin 1980. Guérin & Mourer 1969. Hislop 1968. Hoogerwerf 1954. Hooijer 1945, 1946a, b, 1948, 1962a. Hubback 1939a, b. Hutchinson & Ripley 1954. Lang 1976. H. Lang 1924c. Laurie 1982. Lckagul & McNeely 1977. Loose 1975. McNeely & Laurie 1977. Meinertz 1974, 1975. van Peenen 1969. Prater 1939. Rookmaaker 1973c, 1977c, d, 1980b. Schaurte 1968. Schenkel 1971. Schenkel & Schenkel 1972a. Schneider 1906. Shebbeare 1953. Silberman & Fulton 1979. Skafte 1961. Sody 1937, 1941, 1946. Sonne-Hansen 1972. van Strien 1974a, 1976a, 1977a, 1978a. Thenius 1972. Thomas 1901. Tun Yin 1954a, b, 1955a. Ullrich 1955. Weatherbe 1939. Zeuner 1934. van der Zon 1977.

Dicerorhinus sumatrensis sumatrensis; Harper 1945. Brentjes 1978. Groves 1967a. Groves & Kurt 1972. Guérin 1980. Guggisberg 1966a. van Strien 1974a.

Diceros sumatrensis; Neese 1976a.

Didermoceros sumatrensis; Pocock 1944b. - Ali & Santapau 1959. Basjarudin

1967. Brookes 1828. Bruton 1963. Cave 1958b, 1962a, 1964b, 1965, 1969, 1973, 1974a, b, 1975, 1976a, c, 1979a, 1981, 1982. Cave & Aumonier 1962b, 1963a, b, 1966. Cave & Wingstrand 1972. Crandall 1968. Davis 1962. Deuve & Deuve 1962. Ellerman & Morrison-Scott 1951. Fetherstonhaugh 1951. Harrison 1974. Harrison 1955, 1956, 1965a. Heymans & Colyn 1981. Hislop 1961. Krumbiegel 1965. Llopis 1974b. Lukaszewicz 1962. Medway 1964, 1965b, 1966, 1968a. Miller 1942. Milton 1961. Pocock 1945a, b, 1946c. Reynolds 1971. Schaurte 1966. Schenkel et al. 1978. Schlawe 1969. Scott 1975. Street 1961. Talbot 1960. Tun Yin 1967. Walker 1964. Zumpt 1965.
- Didermoceros sumatrensis sumatrensis*: Grassé 1955. - Groves 1965. Kourist 1973. Ulmer 1958.
- Didermoceros (Ceratorhinus) sumatrensis*: Cave 1976b.
- Didermoceros sumatrensis*: Metcalfe 1961. - Harrison 1964. Khan 1971. Koffend 1974. Strickland 1967.
- Rhinoceros sumatrensis* Fischer 1814. - Anderson 1872, 1878, 1883. Antonius 1914. Arambourg & Fromaget 1938. van Balen 1914. Banks 1931. Bartlett 1891. Beccari 1904. Beddard 1902. Beddard & Treves 1889. Begbie (1834) 1967. van Bemmelen 1915. Blanford 1891. Blyth 1842, 1847b, 1872a. Boettger 1905. Bolau 1879. Buckland 1872. Burgess 1935, 1951. Cabrera 1911. Carpenter 1938. Chenu & Desmarest 1858. Chin 1971. Chochood 1950. Comyn-Platt 1937b. Coomans de Ruiter 1948. Cuvier 1816, 1829, 1836a. Dammerman 1929a. Davis 1958. Delacour 1966. Delsman 1951. Desmarest 1822. Dover 1932. Duncan 1892. Duvernoy 1854. Elliot 1907. Evans 1904, 1905. Evans 1912. Fischer 1829. S. Flower 1900, 1908, 1914, 1931. Flower & Lydekker 1891. Foenander 1952. Friedel 1872b. Fromaget & Saurin 1936. Fytche 1878. Gairdner 1915, 1919. Gee 1950b, 1953a. Gervais 1855. Giebel 1851, 1855. Gyldenstolpe 1914, 1919a, b. Hanitsch 1908. Harrison 1949b. Heck 1896. Heysius-Viruly & van Heurn 1935. Hobley 1932. Inglis et al. 1919. Jentink 1895. Jerdon 1867. Kaup 1833. Kjaersgaard 1974. Kloss 1906, 1909, 1927. Lydekker 1880b, 1883, 1893, 1907a, 1925. Laufer 1914. Lenz 1835. Lesson 1827, 1842. Mason 1882. de Meyere 1894. Milroy 1935. Milton & Estes 1963. Mjöberg 1930. Mukherjee 1974. Neuville 1927. Nicholson & Lydekker 1889. Noll 1873. Osborn 1900. Peacock 1931, 1933. Pollok & Thom 1900. Raffles 1830. Raven 1935. Ridley 1901, 1906. Robinson & Kloss 1918. Sanyal 1892. Sauvaire 1930. Selater 1872a, b, c, g, h, 1873a, 1878, 1885, 1896. W. Selater 1891. Shelford 1916. Shortridge 1915. Smith 1935. Sowerby 1930. Stockley 1928. Suvatti 1950. Swierstra 1888. Thom 1935, 1943. Tjeenk Willink 1905. Trouessart 1898. Tun Yin 1954c. Vageler 1927. Ward 1896. Weber 1904. Westermann 1939. Wood 1930. Wray 1905. Wroughton 1915.
- Rhinoceros (Ceratorhinus) sumatrensis*: Toula 1902.
- 7.2.4 Lapsus in names**
- Dicerorhinus lasiotus*, Sody 1946.
- Didermoceros sumatraensis lasiotus*, Maliepaard & de Vos 1961.
- Didarmoceros sumatrensis lasiotus*, Jenyns 1955: 35.
- Rhinoceros sumatransis*, Anon. 1895.
- Rhinoceros sumatranensis*, Collet 1925.
- Dicerorhinus sumatraensis*, Krumbiegel 1960.
- Didermoceros s. sumatraensis*, Maliepaard & de Vos 1961.
- Didermoceros sumatraensis*, Haltenorth & Trense 1956. -Lang 1959. Anderen 1963.

- Reynolds 1961a. Turek 1961.
- Didermoceros sumatraensis*, Schlawe 1961.
- Rhinoceros (Ceratorhinus) sumatrense*, Bourret 1927.

7.2.5 Lists of synonyms

- Ellerman & Morrison-Scott 1951: 340. Groves 1967a: 230. Groves & Kurt 1972: 1. Hooijer 1946a: 12-16. Lydekker 1916: 49.

7.3 NAMES IN VERNACULAR

General: van Strien 1974a: 68.

Borneo: Banks 1931: 19. Harrison 1964: 210.

Burma: Blanford 1891. Evans 1905: 555. Evans 1912: 121. Mason 1882: 453. Peacock 1933: 71. Prater 1965: 232. Reynolds 1954: 105. Smith 1935: 47. Tun Yin 1967: 157 (Burmese, Kachin, Karen, Shan). Wroughton 1915: 718. Wroughton & Davidson 1918: 475 (Karen).

Laos: Deuve & Deuve 1964: 28. Gairdner 1919: 125.

Malaya: Blanford 1891. Errington 1882: 327 (Malay, Sakai). Fetherstonhaugh 1951b: 230. Foenander 1952: 179 (Malay, Chinese, Cantonese, Kheh). Hanitsch 1908: 8. Heysius-Viruly & van Heurn 1935: 41. Medway 1969: 103. Metcalfe 1961: 185. Miller 1942: 162. Tjeenk Willink 1905: 201.

Thailand: Burkill 1935: 1893. Gairdner 1919: 125. Grose 1914.

7.4 EXTERNAL MORPHOLOGY

7.4.1 Appearance

Anderson 1872, 1883: 76. Antonius 1937. van Balen 1914: 218. Bartlett 1873. Bell 1793. Boitard 1842: 405. Brandt 1878a: 41, 45. Brehm 1877: 516. Bruton 1963: 7. Carter et al. 1946: 153. Chenu & Desmarest 1858: 9. Crandall 1968: 506. Cuvier 1829: 247. Desmarest 1819: 243. Deuve & Deuve 1962: 100. Duncan 1892: 332. S. Flower 1900: 368. Flynn 1978: 6. Foenander 1952: 181. Friedel 1872b: 361. Geoffroy & F. Cuvier 1825. Giebel 1855: 203. Gloger 1841: 125. Grassé 1955: 1111-1113. Groves & Kurt 1972: 1-2. Guggisberg 1966a: 106. Harper 1945: 390. Harrison 1964: 210, 1974: 277. Jardine 1836: 179-181. Krumbiegel 1960: 19. Lekagul & McNeely 1977: 656. Lydekker 1892a, 1907a: 37, 1925: 178. Medway 1969: 103. Metcalfe 1961: 183. Mohnike 1883: 422. Müller & Schlegel 1845: 191. Mukherjee 1974: 343. Noack 1886. Noll 1873: 81. van Peenen 1969: 259. Pocock 1928b. Prater 1965: 232. Reynolds 1968a: 6. Ridley 1901: 106. Sanyal 1892: 134 (newborn). von Schreber 1835: 325-328. Schinz 1824. Selater 1872c: 427. Selous n.d.: 184. Shaw 1800: 207. Smith 1935: 47. Sonne-Hansen 1972: 296. Stockley 1928: 100. van Strien 1974a: 8. Talbot 1960: 169. Tun Yin 1967: 157. Ullrich 1955. Weatherbe 1939: 155. Wood 1851: 756. Wroughton 1915: 719. Zeuner 1934: 33.

7.4.2 Colour

Anderson 1872. Blanford 1891. Dollman 1928: 225 (Perak). Flower 1876 (Borneo). Hose 1893: 63. Hubback 1939a: 597. Müller & Schlegel 1845: 192. Prater 1939: 623. van Strien 1974a: 10. Tjeenk Willink 1905: 201. Wroughton 1915: 719.

Red variety, Badak Api: Blyth 1862a: 161 (Burma). Clifford 1927: 33 (fabulous monster of Malay tradition). Flower 1900: 368. Ridley 1895: 161. Tun Yin 1956: 693.

7.4.3. *Footprints*

Flynn 1978: 6. Hubback 1939a: 599, 610 (sexual difference). Sody 1937: 728 (compared with *R. sondaicus*). van Strien 1978a (difference from *R. sondaicus* in shape and size). Strickland 1967: 3-4 (form, method of measuring, confusion with *Tapirus indicus*).

7.4.4. *Footprint measurements*

Burgess 1951. Flynn 1981a: 5 (Borneo), 1981b: 17 (Malaya). Lekagul & McNeely 1977: 652. Milton 1962: 57 (Malaya). Peacock 1933: 75. van Strien 1974a: 17-19.

7.4.5. *Hair*

Anderson 1872. Blyth 1862a: 158. Cave 1969 (body hair). Cave & Wingstrand 1972 (vibrissae on both eyelids). Dollman 1928: 255 (Perak). Groves 1967a: 222. Hubback 1939a: 597 (fringes). Manson 1876: 177. de Meyere 1894: 375. Pocock 1915 (absence of fringes). Prater 1939: 624. Selater 1872a, b, d, h, 1873a. van Strien 1974a: 11. Ullrich 1955 (young, Sumatra).

7.4.6. *Horn*

Foenander 1952: 182 (Malay distinguish 4 types of horns). Groves 1971: 246-247. Hubback 1939a: 598 (third horn). Lubach 1868 (third horn). Neville 1927: 188. Pryer 1881: 395 (third horn). van Strien 1974a: 11-12.

7.4.7. *Horn measurements*

Anon. 1895. Blyth 1862a: 158, 1868a, b. Christopher 1916: 226. Dammern 1937. Gray 1854. Hubback 1939a: 598. Koffend 1974: 9. Lydekker 1892a, 1900: 28, 1907a: 38, 1907c: 73. Manson 1876: 177. Neville 1927: 188. Otto 1903: 144. Peacock 1933: 71. Pocock 1915. Prater 1939: 624. Ward 1896: 283.

7.4.8. *Size*

Anon. 1895. Anderson 1872. van Balen 1914: 218. Blanford 1891. Boitard 1842: 405. Brandt 1878a: 41. Burton 1962: 210. Chenu & Desmarest 1858: 9. Coenraad-Uhlig 1933: 115. Crandall 1968: 506. Deuve & Deuve 1962: 100. Evans 1904: 160 (Burma female), 1905: 561 (Burma male). Foenander 1952: 182. Guggisberg 1966a: 106. Harrison 1964: 210, 1974: 277. Harper 1945: 390. Hose 1893: 63. Hubback 1939a: 597 (Pahang male, Malaya female). Lekagul & McNeely 1977: 656. Lydekker 1900: 28, 1907a: 37, 1925: 178. Medway 1969: 103. Mohnike 1883: 422. Müller & Schlegel 1845: 192 (Sumatra female). Noack 1886 (Malaya, Hamburg zoo). Peacock 1931: 447 (Burma male), 1933: 71. van Peenen 1969: 259. Prater 1939: 623, 1965: 232. Ridley 1901: 106 (Perak female). Schinz 1824: 289. von Schreber 1835: 238. Selous n.d.: 184. Smith 1935: 47. Sonne-Hansen 1972: 296 (Copenhagen zoo, female). Stockley 1928: 100. van Strien 1974a: 9, 14 (young). Talbot 1960: 169. Tate 1947: 352. Tjeenk Willink 1905: 201. Wroughton 1915: 718 (Tenasserim female).

7.4.9. *Size at birth and growth*

Bartlett 1873. Groves 1965: 128 (growth stages), 1967a: 227 (growth stages based on tooth eruption). Prater 1939: 622.

7.4.10. *Skin*

Neville 1927: 181-182. van Strien 1974a: 10. Wray 1905: 65.

7.4.11. *Age classes*

Groves 1965: 128, 1967a: 227 (growth stages). Guérin 1980: 154-156 (comparison of adult and subadult skulls).

7.4.12. *Sexual dimorphism*

Blyth 1862a: 157 (horns). Guérin 1980: 157, 158 (no difference). Hubback 1939a: 598, 610 (horn length, footprints). Loose 1975: 26 (no sexual characters in skulls). Pocock 1946c: 319 (nasal bones). Thenius 1955a: 4 (nasal septum).

7.5. ANATOMY

7.5.1. *General dissections*

Beddard & Treves 1889 (anatomy of 2 specimens). Garrod 1873. Giebel 1855. Grassé 1955: 1108-1118. Groves & Kurt 1972: 3 (review). Home 1821: 271, pl. 21. von Schreber 1835: 329. van Strien 1974a: 13 (review).

7.5.2. *Organs*

Brain: Garrod 1879.

Epipharynx: Cave 1973 (bursa epipharyngea).

Eye: Cave & Wingstrand 1972 (eyelashes). van Strien 1974a: 12.

Heart: Cave 1981 (cardiac receptor system). Meinertz 1975.

Intestines: Beddard 1902 (small intestine as taxonomic character). Cave & Aumonier 1963a (histology).

Kidney: Meinertz 1974.

Lymph: Cave & Aumonier 1962b (lymph node).

Musculature: Kjaersgaard 1974 (musculus articularis humeri).

Parathyroid: Cave 1976b.

Pedal scent gland: Beddard 1902 (absent).

Penis: Cave 1964b. Forbes 1885. van Strien 1974a: 12.

Reproductive organs: Disselhorst 1904: 317. Evans 1904: 160. van Strien 1974a: 12 (udder).

Thyroid gland: Cave 1976b.

Tonsils: Cave 1979a: 482-486.

7.6. OSTEOLOGY

7.6.1. *Skull*

Cave 1959 (foramen ovale), 1965: 503 (lacrimal epiphysis). Chakraborty 1972: 125-128 (occipital surface, foramen magnum, subaural channel). Flower 1878 (individual variation, lacrimal foramen). Friant 1948 (articulation of lower jaw). Guérin 1980: 33-54 (description). Home 1822: 42 (cavity). van Kampen 1905: 573-575 (tympanal region). Lekagul & McNeely 1977: 652. Loose 1975: 15 (characters), 14 (otic region). Pander & d'Alton 1821: 21, pl. 9a (young skull). Pocock 1915 (individual variation), 1945b (characters). Thenius 1955a (nasal septum). Toulou 1902 (comparison with *R. hundsheimensis*).

7.6.2. *Skull measurements*

Chakraborty 1972. Flower 1878: 635 (8 skulls). Garrod 1873: 93. Gray 1868: 1032 (2 skulls), 1873a: 359 (2 skulls). Groves 1965: 128 (13 skulls), 1967a: 228. Guérin 1980: 49, 53. Hooijer 1946a: 26. Loose 1975: 15, tab. 11 (Zeuner's angles in quartiles).

Miller 1942: 161 (immature male). van Peenen 1969: 259 (Borneo). Toula 1902.

7.6.3 Dentition

de Blainville 1846: 51-58. Desmarest 1819: 243. Gray 1873a: 356. Groves 1967a: 230 (measurements). Guérin 1980: 54-73 (description, measurements). Hooijer 1945: 252, 1946a: 9-12. Lydekker 1880b: 141, 1925: 178. Müller & Schlegel 1845: 191. Owen 1845: 587ff. van Strien 1974a: 13. Toula 1902.

7.6.4 Postcranial skeleton

Clutton-Brock 1965: 10 (scapula size). Giebel 1855: 203. Guérin 1980: 74-152 (descriptions of bones, measurements). Heller 1913: 15 (vertebral formula). Home 1821: 270-271, pl. 22; 1823, pl. 67. Pouchet & Beaugard 1889: 198.

7.7 DISTRIBUTION AND STATUS

7.7.1 General reports

Anon. 1967h. Antonius 1914: 21. Bruton 1963: 8 (map). Coolidge 1964: 33. Ellerman & Morrison-Scott 1951: 340. Groves 1967a: 225 (map). Groves & Kurt 1972: 2 (map). Guggisberg 1966a: 105, fig. 4 (map). Haltenorth & Trense 1956: 108. Krumbiegel 1960: 16 (map). Lydekker 1893: 382, 1907a: 38. Ripley 1966: 149. Schenkel 1980. Simon 1966, 1967. Spinage 1962: 179 (map). van Strien 1974a: 31-35 (maps). 58-64 (legislation). 50-53 (hunting). 1979b (map). Stonehouse 1981: 58 (map). Talbot 1960: 171 (map). WWF 1979 (ban on rhino import from Hong Kong).

7.7.2 Status

Groves & Kurt 1972: 4. Kirk 1968: 150. Llopis 1974b: 21. Prater 1965: 232. Schenkel & Lang 1969: 1. van Strien 1974a: 31-35.

7.7.3 Bhutan

Blanford 1891. Lydekker 1900: 29, 1907a: 38.

7.7.4 Borneo

Review: Borner 1979a: 67. Brandt 1878a: 44. Groves & Kurt 1972: 4. Harper 1945: 391-393. Jentink 1884, 1895. Medway 1977: 144-145. Rookmaaker 1977c, d. van Strien 1974a: 29-31. Talbot 1960: 182-183.

Status: Anon. 1963c. Bartlett 1891. Bruton 1963: 8. Comyn-Platt 1937b: 54. Fitter 1968: 58. Grzimek 1958: 118. Harrison 1948, 1949b, 1965a, 1965b: xix, 1975. Simon 1966, 1967.

Hunting: Hose 1926: 106 (Punans; spears, poisoned darts). Hose & McDougall 1966: 145 (Punans). Krohn 1927: 246 (rhino spear). Nieuwenhuis 1900. II: 61, 66 (Kayans, Punans). Pfeffer 1963: 89 (Kalimantan). Piazzini 1963: 163 (Punans). Rookmaaker 1977b: 296 (review).

Legislation: Chin 1971: 359 (Sarawak).

'Borneo' only: Anon. 1851: 454. van Balen 1914: 219. de Beaufort 1926: 60. van Bemmelen 1969: 70. van Bemmelen 1915: 92. Blanford 1891. Blyth 1862a: 170, 1863a: 156, 1872b: 3108, 1875: 53. Carter et al. 1946: 153. Chasen 1940: 207. Collet 1925: 66. Coomans de Ruiter 1948: 156. Dammerman 1937. Delsman 1951: 82. Deuve & Deuve 1962: 100. Dollman 1937: 73. Everett 1893. Flower 1900: 368. Foerander 1952: 183. Fraser 1869. Gyldenstolpe 1919a: 56. Hagen 1890: 105. Hanitsch 1908: 8.

Hoogerwerf 1954: 224. Hose 1896: 105. Hose & McDougall 1966: 3, 143. Hubback 1939a: 594. Jentink 1889: 25. Laurie & Olivier 1977: 660. Loch 1937: 145. Loose 1975: 16. Lydekker 1900: 29, 1925: 178. Maliepaard & de Vos 1961: 96. van Martens 1876: 257. Medway 1969: 103. Müller 1839: 39. Pollok & Thom 1900: 166. Prater 1965: 232. Raven 1935: 261. Sowerby 1930: 218. Street 1961: 110. Strickland 1967: 1. Schwane 1853: 36. Selous n.d.: 184. Tate 1947: 353. Tjeenk Willink 1905: 201. Ward 1896: 283.

Absence asserted: Jentink 1881: 293 (uncertain). Jerdon 1867: 234. Murray 1868a (uncertain), 1868b: 373 (uncertain). Temminck 1847: 410 (uncertain). Veth 1854: xii (uncertain).

Records:

Borneo general: Bruce 1924: 70 (Tempasuk dt.). Guggisberg 1966a: 103-105. Harrison 1938: 245, 1956: 264, 1961a. Jentink 1897: 64 (localities). Medway 1965a: 155-156. Shelford 1916: 41 (interior). Spenser St. John 1863. II: 246 (rare in wilder parts).

Brunei: van Lynden & Groll 1851: 565.

Kalimantan: Anon. 1937a (Bukit Raja, Kutai), 1937b (Kutai), 1958b (Kutai). Bock 1881: 251 (Kutai). Buys 1927: 45 (Kong Kemoel). Endert 1927: 173 (Kong Kemoel). Fischer 1910: 278 (Apo Kayan). Groves 1967a: 223. Harrison 1949a: 139 (Apo Kayan in 1945), 1949b (localities), 1955, 1975: 71 (R. Bahau, 1945). Hoogerwerf & van Steenis 1936: 97 (Boekit Raja). Hose 1893: 63 (interior). Keller 1932 (R. Koetai). van Lynden & Groll 1851: 565 (Kottaringin). Lyon 1911: 54, 56, 58 (localities in S.W. Kalimantan). Merens 1910: 545 (Apo Kayan). Mjöberg 1929: 108, 113 (Apo Kayan), 1930: 10-13 (R. Boh). Moor 1837, appendix p. 18 (Kalimantan). Nederlandsche Commissie 1937a (Paloeng Mt.). Nieuwenhuis 1900. II: 61, 319 (upper Mahakam, Ajo Mt.), 1904: 361, 392 (Mts. Situn, Lesong). Pfeffer 1958: 132-138 (localities in N. and E. Kalimantan). Piazzini 1963: 163 (ulu Bahau). Schneeberger 1945: 562 (Kelabit plateau). van Strien 1981a (Kutai reserve, no viable population). van Strien et al. 1979 (Kutai reserve). Tehupeiory 1906: 47, 86, 101, 104, 191 (Apo Kayan, localities). Tillema 1936: 45, 77, 50 (Apo Kayan). de Voogd & Siccama 1939: 139, 141 (localities). Westermann 1939: 337, 345, 352 (localities). Witkamp 1932a: 172 (Kutai, localities), 1932b (Kutai, localities). van der Zon 1977 (absent from Bukit Raya; Kutai game reserve). Zondag 1931: 222 (localities).

Sabah: Anon. 1981b (Silabukan forest reserve, 1 died). Burbidge 1880: 302 (R. Sagaliad). Burgess 1961: 150. Carson 1968: 496 (status). Corner 1964: 7, 20, 29 (Mt. Kinabalu). Davies & Payne 1981: 120 (Silabukan). Davis 1962: 120 (Tingkayu 1927). Evans 1922: 58 (between Kinabalu and Kudat). Fitter 1974b: 445. Flower 1880. Flynn 1981a: 1, 1982 (recent reports; Silabukan area survey: 4-6 present). Gomes 1911: 149. Jenkins 1971: 177 (Mt. Kinabalu 1961; Mt. Tambuyokan 1970). Kiew & Furtado 1977 (Danum valley). MacKinnon 1970 (recent reports, status), 1974: 37, 112, 198 (Segama). Pryer 1881: 394 (Sandakan bay), 1886 (Sandakan). Sandilands 1974 (Karamuah, Tambunan, 1920's). Shelford 1916: 41 (status). de Silva 1968: 145 (tracks in 1957). Wycherley 1969: 146 (status).

Sarawak: Arnold 1959: 93-94 (Usan Apau). Banks 1931: 19, 1935: 329 (Mt. Mulu), 1937, 1978: 224. Bartlett 1891 (Rajah R.). Beccari 1904: 311. Davis 1958: 146 (Kelabit plateau). Harrison 1938: 231 (Mt. Kalulong), 1949b (localities), 1956: 263, 264 (R. Bahau; status), 1961b: 90 (status). Mjöberg 1929: 68 (R. Baram).

7.7.5 Burma

Review: Ansell 1947. Groves & Kurt 1972: 4. Harper 1945: 395. van Strien 1974a:

20-24. Talbot 1960: 174-178.

Status: Anon. 1963c. Ansell 1947: 264. Borner 1979a: 66. Bruton 1963: 8. Fitter 1968: 58, 1974b: 445. Maliepaard & de Vos 1961: 96 (in 1947, 1955). Reynolds 1954: 106. Shebbeare 1953: 148. Simon 1966, 1967. Thom 1943: 258.

Legislation: Ansell 1947: 254-256. Reynolds 1954: 104. Tun Yin 1954b: 265, 1967: 162.

'Burma' only: Blyth 1863b: 137, 1875: 52. Brandt 1878a: 44. Burton 1951: 729. Flower 1900: 368. Foenander 1952: 183. Groves 1967a: 223. Grzimek 1958: 118. Hobley 1932: 20. Hubback 1939a: 594. Hanitsch 1908: 8. Laurie & Olivier 1977: 660. Lydekker 1900: 29, 1925: 178. Medway 1969: 103. Pollok 1879, 1: 94. Sanyal 1892: 131. Selous n.d.: 184. Sterndale 1884. Stockley 1928: 101. Street 1961: 110. Strickland 1967: 1. Tate 1947: 353. Ward 1896: 283.

Records: Anon. 1935: 91 (localities). Anderson 1872: 129 (Mogony dt.), 1878: xxi (Mogoung dt.), 1889: 333 (Kisseraing island, unidentified: High island, double-horned). Blyth 1842: 448 (Ye), 1868b: 130 (Yunzalia dt.; Martaban), 1872a (upper 'urmah), 1875: 52 (Arakan hills: R. crossii). Borner 1979a: 66. Cantor 1846: 263 (probably Tenasserim). Christison 1945 (Arakan, localities, map). Christopher 1916: 226, 230-233 (several records). Deuve & Deuve 1962: 100 (localities). Evans 1905: 557 (upper and lower Burma). Evans 1912: 122 (Tavoy, Shan states). Faunthorpe 1924a (lower Burma). Fitter 1968: 58. Fytche 1878: 104 (Tavoy dt.). Guggisberg 1966a: 103, 105. Helfer 1838: 860 (Tenasserim). Henri d'Orléans 1898: 320 (Nam Tsai, Singpho area - cf. Hubback 1939a: 596). Lang 1924c: 528 (Pegu). Low 1836: 50 (Tenasserim). Luce & Tin 1939: 267 (central Burma, 4th century). Lydekker 1900: 30 (Mergui), 1905: 152 (Singpho), 1907a: 32-34 (Singpho). Mason 1882: 453 (coast near Koranji island, 1866, skulls sent to British Museum: Arakan). Milton & Estes 1963: 62 (Tenasserim). Mukherjee 1974: 343. Peacock 1931: 447 (between rivers Uyu and Chindwin), 1933: 72 (localities). Pollok & Thom 1900: 166, 167 (Mergui; Ruby Mines dt.), 82 (Cape Negrais, one shot). Prater 1965: 232. Reynolds 1954: 106-107 (localities). Schenkel & Schenkel 1980. Selater 1862 (Tavoy, near Siam border). Shortridge 1915: 772, 774 (Victoria Point, near Bankachon and Maliwun). Smith 1935: 49. Thom 1935: 141 (Arakan, Yoma), 1943: 267, 274 (localities in Arakan and Pegu Yomas). Tun Yin 1954a, c (reports listed), 1955a (Minbu forest division), 1956 (records Kachin state 1955-56), 1967 (list of reports), 1980 (recent reports). Vernay 1924: 625, 627 (Pegu Yomas, one shot, one captured 1924). Wroughton 1915: 718 (Bankachon, Victoria Point 1914). Wroughton & Davidson 1918: 475 (Pegu, tracks 1915-16).

Kahlu Game Reserve: Hubback 1939a. E.E. Peacock 1931: 53 (possibly *R. sondaicus*). Shebbeare 1953: 146. Tun Yin 1954a: 83-84 (reports 1948-1953), 1954b: 274 (reports 1939-1948), 1955b (reports 1946-1948), 1967: 158 (seen in 1940). Weatherbe 1939, 1940: 152 (status).

Schwe-U-Daung Game Reserve: Ali & Santapau 1959 (status). Milton 1961 (status). Milton & Estes 1963: 11 (status since 1940). E.E. Peacock 1931 (one seen). Peacock 1931: 447, 1933: 72 (fairly common). Thom 1935: 141. Tun Yin 1954b: 275 (status 1948-1951), 1955b: 95 (status 1939, 1948, poaching). Weatherbe 1940: 152 (still common).

7.7.6 India and Bangladesh

Review: Harper 1945: 394-395. Mukherjee 1974: 344, map. Rookmaaker 1980b: 255-258. van Strien 1974a: 20. Talbot 1960: 174.

Legislation: Bengal Government 1932.

'India' only: Deuve & Deuve 1962: 100. Flower 1900: 268. Grzimek 1958: 118. Hanitsch 1908: 8. Henri d'Orléans 1898: 320. Hubback 1939a: 594. Lydekker 1900: 29, 1925: 178. Maliepaard & de Vos 1961: 96. Mason 1882: 453. Medway 1969: 103. Selater 1872c: 427. Selous n.d.: 184. Strickland 1967: 1. Tate 1947: 353.

Records: Anderson 1872 (Chittagong, Cossyah hills). Baker 1887: 249 (Chittagong). Blanford 1891. Blyth 1862d: 366 (Assam, 1 killed), 1863a: 156 (Assam), 1872a: 400 (Assam, 1 killed), 1872b: 3106 (trophy seen), 1875: 52 (Assam, Chittagong). Borner 1979a: 66. Cockburn 1883: 63 (Garo, Khassia and Naga hills). Foenander 1952: 182 (Assam). Gee 1948b: 64 (Sona Rupa), 1950a: 85 (Tirap Frontier Tract), 1964: 157 (Mizo hills, until 1935). Guggisberg 1966a: 102. Hobley 1932: 20. Hood 1869 (R. Sungoo, Chittagong). Inglis et al. 1919: 825 (Jalpaiguri dt.: R. Sankos 1864, Dalgaoon forest). Jerdon 1867: 234 (as far north as 23° N). Lydekker 1907a: 38 (Assam, Tippera). Manson 1876: 177 (near Comilla; R. Sungoo, Chittagong). Milroy 1935: 102 (Lushai, Manipur, N. Cachar). Milton & Estes 1963: 42 (Naga hills, Lasai tract). Pollok & Thom 1900: 166 (Assam, Comilla 1876). Sanyal 1892: 131. Selater 1875b (Dohbree), 1877 (Comilla; Sunderbans). Shebbeare 1953: 147 (Assam unconfirmed, possibly 1 killed 1952; Tirap Frontier Tract). Stockley 1928: 101. Stracey 1949: 470 (Assam, records 1875-1949). Ward 1896: 283 (Assam).

7.7.7 Malaya

Review: Metcalfe 1961: 185. van Strien 1974a: 25-27. Talbot 1960: 180-181.

Status: Anon. 1963c, 1967c. Borner 1979a: 66. Bruton 1963: 8. Fitter 1968: 58, 1974b: 445. Hislop 1966, 1968: 278. Koffend 1974: 9. Schenkel & Schenkel 1980. Simon 1966, 1967. Stevens 1968: 15. Wycherley 1969: 146.

Hunting: Begbie 1967: 7-8 (Semangs, in mud). Errington 1882: 334 (Sakai, poisoned arrows). Hubback 1939a: 612. de Morgan 1885: 650 (Sakai, poisoned arrows). Skeat & Blagden 1906: 203, 207 (Semangs, in mud; Sakai, spring-spear traps). Wray 1905: 63 (pitfalls).

Legislation: Foenander 1952: 190. Strickland 1967: 1. Wycherley 1969: 146.

'Malaya' only: de Beaufort 1926: 60. Blanford 1891. Blyth 1863a: 156, 1863b: 137, 1875: 53. Brandt 1878a: 44. Cantor 1846: 263. Chasen 1940: 207. Deuve & Deuve 1962: 100. Giebel 1855: 204. Hagen 1881: 556. Hanitsch 1908: 8. Harrison 1974: 277. Kloss 1906: 148, 1909: 36. Laurie & Olivier 1977: 660. Lydekker 1900: 29, 1925: 178. Maliepaard & de Vos 1961: 96. Mason 1882: 453. Medway & Balasingan 1968: 465. Newbold 1838: 70. Noll 1873: 82. Pollok & Thom 1900: 166. Prater 1965: 232. Raven 1935: 261. Selater 1872c: 427. Selous n.d.: 184. Sterndale 1884. Stockley 1928: 101. Street 1961: 110. Strickland 1967: 1. Swierstra 1888: 19. Tate 1947: 353. Ward 1896: 283.

Records: Anon. 1967g (Selangor, R. Dusun), 1970b (Johor, Combak Pukin). Barnes 1903: 7 (Pahang, Mt. Benom, rhino dung). Bequaert 1933: 137, 140 (Selangor, R. Bernam). Berger 1934: 97 (Selangor, R. Bernam, shot by Vernay 1933). Boettger 1905 (Perak, Dindings). Borner 1979a: 66. Flower 1900: 367, 368 (localities). Foenander 1952: 183 (localities). Groves 1967a: 223 (mainly in west). Guggisberg 1966a: 105. Hislop 1966, 1968: 278, 280, 281 (localities, map). Hubback 1939a: 614, pl. 2 (N. Pahang, ulu Benus). MacKie 1965: 186 (Perak). Marchette 1965: 130 (Kedah, Mt. Jerai, tracks by tapir, vs. Ridley 1900). Mayer 1922: 125 (Trengganu, R. Stü, 1 caught). Medway 1968a (Selangor, R. Dusun), 1969: 103 (isolated). Milton 1962: 57 (Selangor 1953, 1957). Moor 1837: 248 (Johor, Naning, unidentified). O'Hara 1907 (Perak, Dindings, 1 caught). Pagden 1965 (Kedah, Mt.

Jerai, seen ca. 1925). Pocock 1915 (Selangor, Pertang, Jelebu, 2 shot by Hubback). Ridley 1900: 27 (Kedah, Mt. Jerai: turf ploughed up by rhino), 1901: 106 (Perak, S'tiawan, 2 trapped). Schaurte 1968: 286. Shuttleworth 1967: 89, 90 (Johor, Endau region I seen; ulu Tiram I shot 1948). Soepadmo 1970 (animal reported in N. Pahang probably is tapir). Stevens 1968: 12, 15. Strickland 1968 (R. Dusun). van Strien 1974b: 62 (Selangor, R. Dusun). Strugnell & Willbourn 1932: 19 (Pahang, Mt. Benom, tracks). Swettenham 1895: 94 (Perak 1876). Wallace 1869: 26 (Johor, Mt. Ophir, unidentified).

Endau-Rompin, Pahang: Anon. 1976a, 1978d. Flynn 1978: 10 (impact of logging), 1979 (status), 1980 (status), 1981b (distribution and status: 20-25 present), 1982 (status). Scott 1975 (status; research by Flynn). van Strien 1977d: 2.

Taman Negara, Pahang: Anon. 1951: 202 (tracks), 1971d (status and distribution, fig. 3). Fetherstonhaugh 1951b: 230. Hislop 1961: 98. Khan 1971: 128 (recent reports). McKie 1965: 186 (in 1940). Malaya Game dept. 1950: 88. Ridley 1894: 59 (Tahan river woods).

Slim River, Perak, picture taken on Lima Bilas oil estate by G. Bazin in 1958. Identified as *R. sondaicus* by Ali & Santapau 1958b, Grzimek 1958: 119 and Hoogerwerf 1970: 53. Identified as *D. sumatrensis* by Groves & Kurt 1972, Grzimek 1960a: 22, Maliepaard & de Vos 1961: 94, Metcalfe 1961, pl. 33, Shuttleworth 1967: 89.

7.7.8 Sumatra

Review: Borner 1979a: 22, 28-57, 63. Guggisberg 1966a: 102, 105. Harper 1945: 390. van Strien 1974a: 27-29. Talbot 1960: 181.

Status: Anon. 1963c. Borner 1979a: 35, 58-64. Bruton 1963: 8. Fitter 1968: 58, 1974b: 445. Groves & Kurt 1972: 4. Grzimek 1958: 118. Heynsius-Viruly & van Heurn 1935: 46. Pfeffer 1958: 132. Schenkel & Schenkel 1969a, 1980. Shebbeare 1953: 148. Simon 1966, 1967. Talbot 1960: 182.

Hunting: Anon. 1937b, c. van Balen 1914: 220. Bickmore 1868: 495 (pitfalls). Borner 1979a: 33-34 (traps). Coenraad-Uhlig 1933 (pitfalls). Collet 1925: 219. Groeneveldt 1938: 107. Hagen 1881: 556. van Hasselt 1881: 59, pl. 123 fig. 2 (spear mechanism). Hoogerwerf 1939b: 283. Kops 1919: 97. Kreemer 1923, II: 118, 120 (pitfalls, knives). Müller & Schlegel 1845: 192 (pitfalls). Snouck Hurgronje 1903: 360 (trap with sharp wood). van Steenis 1938 (pitfalls). van Strien 1975, 1976c (traps, snares). Veth 1873: 709 (pitfalls).

Legislation: Basjarudin 1967. Olivier 1916: 156.

'Sumatra' only: Anon. 1851: 454. van Balen 1914: 219. Begbie 1967: 510. van Bemmelen 1969: 70. van Bemmelen 1915: 92. Blandford 1891. Blyth 1863b: 137, 1872b: 3107, 1875: 53. Boitard 1842: 405. Brandt 1878a: 44. Carter et al. 1946: 153. Chasen 1940: 207. Collet 1925: 66. Coomans de Ruiter 1948: 153. Delsman 1951: 82. Desmarest 1819: 244. Deuve & Deuve 1962: 100. Fischer 1829: 415. Flower 1900: 368. Foenander 1952: 183. Giebel 1855. Hagen 1890: 105. Hanitsch 1908: 8. Heynsius-Viruly & van Heurn 1935: 42. Hoogerwerf 1954: 224. Hubback 1939a: 594. Jentink 1881: 293, 1895. Jerdon 1867: 234. Kops 1919: 7, 93, 97. Laurie & Olivier 1977: 660. Loose 1975: 16. Lydekker 1900: 29, 1925: 178. Marsden 1811: 116. von Martens 1876: 257. Medway 1969: 103. Milton 1964a. Mohnike 1883: 420. Noll 1873: 82. Pollok & Thom 1900: 166. Polo 1958: 253 (unicorn in lesser Java). Prater 1965: 232. Raffles 1822, 1830: 441, 644. Raven 1935: 261. Robinson & Kloss 1918: 74. Schinz 1824. Sclater 1872c: 427. Scelous n.d.: 184. Snelleman 1887: 26. Snouck Hurgronje 1903: 360. Sowerby 1930: 218. Sterndale 1884. Street 1961: 110. Strickland 1967.

Swierstra 1888: 19. Tate 1947: 353. Temminck 1835: viii. Tjeenk Willink 1905: 201. Veth 1873: 709. Ward 1896: 283. Wycherley 1969: 146.

Records: Andersen 1963 (R. Siak). Anderson (1826) 1971: 284 (east coast). Basjarudin 1968: 391. Bickmore 1868: 495, 508 (Agar Sumpur). Bock 1881: 279 (Sidjoengdjoeng). Borner 1974c, d, e, 1975a, 1979a (recent reports), 1975c (Kerinci-Seblat area). Bünnemeijer 1921: 35 (Korintji). Carpenter 1938: 62 (localities in Aceh). Coomans de Ruiter 1928: 35, 38 (Palembang). Dammerman 1926: 316 (possibly Abang besar, Riau-Lingga archipelago, unidentified), 1932: 124 (Simalambe mts. 1912), 1937 (Lampongs). Forbes 1885: 158, 166 (Mt. Tengamus). Groeneveldt 1938 (localities). Grzimek 1960a: 22 (R. Siak). Hariert 1901-02: 166 (Atjeh; Serdang, I seen). Hartmann 1936: 55 (Tanggamos mts. unidentified). Heynsius-Viruly & van Heurn 1935: 82, 84, 86, 87 (recent sightings). Hijmans van Anrooij 1885: 276 (R. Siak). Jentink 1889: 25 (Tandjong Morawa, collected by Hagen). Junghuhn 1847: 112 (Lubu Radja, Battalinder, unidentified). J. Kruij 1877: 130 (R. Rajah, Atjeh). Lekkerkerker 1916: 93, 107 (Aceh, unidentified). Lyon 1908: 622 (Aru Bay, tracks). MacKinnon 1973: 240 (Aceh: R. Alas, north of Kutatjane). Maliepaard & de Vos 1961: 96 (south). Milton 1963 (R. Siak, none seen), 1964b (R. Siak, none left). Müller & Schlegel 1845: 192 (mts. east of Padang). Neumann 1885: 128 (R. Pane, R. Bila, unidentified). Otto 1903: 139-145 (R. Lapan, Paya Atjeh, I shot). Rappard 1936: 112 (South, tracks). von Rosenberg 1878: 104 (in mountains, rarely seen). Rudin 1935 (Ranau, Palembang). Schneider 1906: 123, 125, map facing p. 130 (localities; shot Tandjung Laut). Skafte 1961, 1962, 1964 (R. Siak). van Steenis 1938 (Kapi, Atjeh). Taman 1961 (R. Siak, Riau). Ullrich 1955 (Atjeh, Langsar 1928). Verbeek 1883: 659 (Kotta Baroe). Volz 1912: 373 (Karo mts.). de Voogd 1933 (south, unidentified). de Voogd & Siccama 1939: 109, 111, 114, 118, 125 (recent reports). van Waterschoot 1928: 57 (Indrapocra). Zondervan 1891: 534 (R. Kwantan).

Gunung Leuser reserve: Anon. 1937c. Borner 1974a, b, c, 1975a, b, 1979a. Carpenter 1938: 62. Depari 1979. van Heurn 1928: 51. van Hooff 1978: 119. Hoogerwerf 1939b: 276, 281. Kurt 1970a, b. Miller 1942: 162. Milton 1964c. Schenkel & Schenkel 1972a. Scheygrond 1971: 43, 1972: 200. van Steenis 1938. van Strien 1974b, 1975, 1976a-c, 1977b, c, d, 1978b, 1979a-d, 1981b.

7.7.9. Thailand

Review: Borner 1979a: 66. Harper 1945: 395. van Strien 1974a: 24. Talbot 1960: 178.

Status: Anon. 1963c. Bruton 1963: 8. Fitter 1974b: 445. Schenkel & Schenkel 1980.

Hunting: Gyldenstolpe 1916: 51 (impossible from elephant back). Pallegoix 1854: 75 (with bamboo sticks).

'Thailand' only: Blandford 1891. Blyth 1863a: 156, 1872b: 3108, 1875: 53. Bourret 1927: 62. Brandt 1878a: 44. Cheminaud 1939: 78, 82. Flower 1900: 368. Foenander 1952: 183. Grzimek 1958: 118. Hatting 1967: 164. Hubback 1939a: 594. Laurie & Olivier 1977: 660. Lydekker 1900: 29, 1925: 178. Maliepaard & de Vos 1961: 96. Medway 1969: 103. Pallegoix 1854: 156. Pollok & Thom 1900: 166. Prater 1965: 232. Selous n.d.: 184. Sterndale 1884. Street 1961: 110. Strickland 1967: 1. Suvatti 1950: 587. Tate 1947: 353. Ward 1896: 283.

Records: Anon. 1974d (Khao Soi Daow G.R., Chantaburi prov.). Deuve & Deuve 1962: 100 (Tenasserim). Fitter 1968: 58 (Tenasserim border). Gairdner 1915: 136 (Ratburi and Peichaburi dts.). Guggisberg 1966a: 105 (south).

Gyldenstolpe 1914: 28 (north and east), 1916: 50 (Chieng Hai), 1919b: 170 (S.W. and north). Hatting 1967: 156, 164 (Ban Kao, neolithic). Lekagul 1963 (Karnchanaburi dt. 1953-62), 1972 (Chaiyaphoom, Krabi, Trang provinces). Lekagul & McNeely 1977: 656. Low 1836: 44 (Keddah, unidentified).

7.7.10 Prehistoric occurrence

General: Groves & Kurt 1972: 2-3 (review). Guérin 1980: 168 (review). Hooijer 1946a: 27 (size diminution during holocene), 1949: 125 (prehistoric Sumatran specimens larger than recent Sumatran specimens).

Borneo: Banks 1931: 21. Beccari 1904: 135 (Bau). Busk 1869 (fossil teeth identified as *R. sondaicus*). Harrison 1957: 164 (Niah). Hooijer 1945, 1946a: 10 (teeth described by Busk are *D. sumatrensis*). Medway 1958, 1959: 157, 1964, 1966 (Niah), 1965b (Niah, rhinos equal in size or fractionally larger than recent specimens; teeth described by Busk are *D. sumatrensis*). Rookmaaker 1977c: 56 (review).

Sumatra: Hooijer 1946a: 16-29 (size diminution during holocene; description of Sumatran material). Sody 1946 (proposed *Dicerorhinus sumatrensis eugenei*, type-specimen: M² coll. Dubois no. 662a (Museum Leiden). Ng'au Ajer, near Pajakombo, Sumatra; larger than recent subspecies).

7.8. ECOLOGY AND BEHAVIOUR

7.8.1 Field studies

Borner 1979a. Flynn 1978-1981. Hubback 1939a, b. Strickland 1967 (summarized in Medway 1968). van Strien 1975-1979.

7.8.2 General reports

Brehm 1877: 520ff. Groves & Kurt 1972: 3-4. Guggisberg 1966a: 107-113. Haltenorth & Trense 1956: 108. Laurie 1982: 332-338 (comparison with other species). Smith 1935: 48. Sonne-Hansen 1972 (Copenhagen zoo). van Strien 1974a (review). Tun Yin 1967: 158-162.

7.8.3 Activity pattern

Anon. 1935: 91. Ansell 1947: 252. Borner 1979a: 137. Bruton 1963: 7. Fytche 1878: 105. Hagen 1890: 105. Metcalfe 1961: 187. Prater 1965: 233. Ridley 1901: 106. Sonne-Hansen 1972. Strickland 1967: 9-10.

7.8.4 Defecation and urination

Andersen 1963. Banks 1978: 227. Borner 1979a: 94-101 (defecation), 101-105 (urination). Flynn 1978: 8 (scent-marking). Foenander 1952: 189 (sex determined by way of urinating). Hubback 1939a: 599 (sexual difference in urinating). Lang 1959. Prater 1939: 625. Schenkel & Lang 1969: 42. Sonne-Hansen 1972. van Strien 1974a: 42. Talbot 1960: 185. Thom 1935: 141, 1943: 272.

7.8.5 Dung heaps

Anon. 1935: 91. Ansell 1947: 252. Banks 1931: 20. Borner 1979a: 96-98. Foenander 1952: 188. Hubback 1939a: 609 (absence). Metcalfe 1961: 187. Peacock 1931: 448 (presence), 1933: 73 (up to 2 feet high). Prater 1939: 625, 1965: 233. Ridley 1901: 106. Strickland 1967: 12 (absence). Thom 1935: 141. Ullrich 1955.

7.8.6 Food

Anon. 1935: 91. Andersen 1963. Ansell 1947: 252. Banks 1978: 224. Borner 1979a:

75, 82-90 (methods, plants). Bruton 1963: 7. Coenraad-Uhlig 1933: 115. Evans 1905: 558 (plants). Flynn 1978: 7, 1981b: 23-27 (plants). Foenander 1952: 186 (plants). Guérin 1980: 178. Harrison 1974: 277. Hubback 1933 (flowers of *Ashoka tree*, *Saraca* sp.), 1939a: 603, 607-608 (plants, methods). Medway 1969: 103 (plants, methods). Metcalfe 1961: 188, 189 (plants). Pallegoix 1854: 156. Peacock 1931: 448 (methods), 1933: 73 (plants, methods). Prater 1939: 626, 1965: 233. Schenkel & Lang 1969: 42. Shortridge 1915: 773. Strickland 1967: 10-11, 16-17 (methods, plants). van Strien 1974a: 39-41, 69-72 (methods, plants), 1974b: 63. Talbot 1960: 186. Tate 1947: 353. Thom 1935: 142-143 (plants).

7.8.7 Habitat

Anon. 1935: 91. Ansell 1947: 252. Banks 1978: 224. Bickmore 1868: 509. Borner 1979a: 69-82. Bruton 1963: 6. Carter et al. 1946: 153. Delsman 1951: 16. Evans 1905: 557, 1912: 123. Flynn 1981b: 27. Foenander 1952: 183. Harrison 1964: 211, 1974: 278. Hose 1893: 63. Hubback 1939a: 599, 602. Loose 1975: 16. Lydekker 1907a: 39. Medway 1969: 103. Metcalfe 1961: 187. Mukherjee 1974: 343. E.E. Peacock 1931: 53 (at 5,000 feet). E.H. Peacock 1931: 447 (dense forest), 1933: 72 (forest clad hills). Prater 1965: 232. von Rosenberg 1878: 104 (at 6,000 feet). Schenkel & Lang 1969: 42. Schenkel & Schenkel 1980. Schinz 1824: 289. Selous n.d.: 184. Shebbeare 1953: 147. Shortridge 1915: 773. Strickland 1967: 12. van Strien 1974a: 35-37, 1974b: 62, 1977d: 2, 1978a: 16. Strugnell & Willbourn 1932: 19 (at 5,500 feet). Talbot 1960: 183. Tate 1947: 353. Thom 1935: 139 (seasonally determined), 1943: 266 (high altitude). Tjeenk Willink 1905: 201.

7.8.8 Home range

Borner 1979a: 138-145. Flynn 1978: 7, 1981b: 20 (density). Groeneveldt 1938: 107. Strickland 1967: 6-9. van Strien 1974a: 38.

7.8.9 Horn rubbing

Hubback 1939a: 609. Sonne-Hansen 1972.

7.8.10 Longevity

Bolau 1879: 110 (Hamburg zoo). Dover 1932: 87 (captivity, 10-35 years). Flower 1931 (captivity, records). Foenander 1952: 187. Medway 1969: 104 (captivity). Mitchell 1911a: 453 (captivity, 271 months). Reynolds 1961a: 33 (captivity).

7.8.11 Movements and paths

Anon. 1935: 91. Ansell 1947: 252. Banks 1978: 224. Borner 1979a: 112-115 (trails), 146-148 (movements). Bruton 1963: 7. Evans 1905: 557, 1912: 122. Foenander 1952: 185 (wandering). Heynsius-Viruly & van Heurn 1935: 42 (tunnels). Hubback 1939a: 601-602. Prater 1965: 233. Schenkel & Lang 1969: 42 (nomadism). Shortridge 1915: 773. Sonne-Hansen 1972 (path). Strickland 1967: 11-12 (trails). van Strien 1974a: 15-16, 38-39 (tracks, wandering), 1976e: 3. Talbot 1960: 186 (wandering). Thom 1935: 139, 141, 1943: 272. Wroughton & Davidson 1918: 475.

7.8.12 Population structure

van Strien 1976e: 3.

7.8.13 Relations with men

Bruton 1963: 7. Evans 1905: 555. Hagen 1881: 556. Heynsius-Viruly & van Heurn

1935: 42. Hose 1893: 63 (taming). Miller 1942: 162. Mohnike 1883: 442 (less dangerous than *R. sondaicus*). Müller & Schlegel 1845: 192. Ridley 1901: 106. Schneider 1906: 123. Selous n.d.: 184. van Strien 1974a: 45-47. Wood 1851: 756.

7.8.14 *Relations with other animals*

General: Strickland 1967: 10.

Elephant: Bickmore 1868: 509 (enmity unknown on Sumatra). Selater 1872f. van Strien 1974a: 45.

Rhinoceros sondaicus: Borner 1979a: 78-79. Groves 1967a: 226 (ecological displacement).

Tiger: Borner 1979a: 74. Evans 1904: 161. Talbot 1960: 186.

7.8.15 *Resting*

Borner 1979a: 110. Krumbiegel 1965. van Strien 1974a: 44.

7.8.16 *Salt licks*

Borner 1979a: 90-93. Foenander 1952: 186. Medway 1969: 103. van Strien 1974a: 39.

7.8.17 *Senses*

Ansell 1947: 252. Banks 1978: 226. Hubback 1939a: 605. Prater 1965: 233. van Strien 1974a: 16. Talbot 1960: 186. Thom 1935: 140.

7.8.18 *Social relations*

Banks 1931: 19. Borner 1979a: 116-135. Bruton 1963: 7. Evans 1905: 557. Hagen 1890: 105. Hubback 1939a: 600. Medway 1969: 103. Mjöberg 1930: 11. E.H. Peacock 1931: 448. Schenkel & Lang 1969: 42. Schinz 1824. Shortridge 1915: 773. van Strien 1974a: 44-45. Tate 1947: 353. Wroughton & Davidson 1918: 475.

7.8.19 *Swimming*

Borner 1979a: 110. Evans 1905: 560. Foenander 1952: 183. Hubback 1939a: 604. Lydekker 1907a: 39. Pollok & Thom 1900: 166. Shortridge 1915: 773. van Strien 1974a: 16. Talbot 1960: 186.

7.8.20 *Territory*

Borner 1979a: 149-150 (male territory).

7.8.21 *Voice*

Evans 1904: 161, 1905: 559. Foenander 1952: 182. Hubback 1939a: 601, 606. Medway 1969: 103. Ridley 1901: 106. Sanyal 1892: 134. Schneider 1906: 123. Sonne-Hansen 1972. van Strien 1974a: 16-17. Thom 1943: 268, 271.

7.8.22 *Wallowing and bathing*

Anon. 1935: 91. Ansell 1947: 252. Banks 1978: 226. Borner 1979a: 105-109. Bruton 1963: 7. Christopher 1916: 227. Evans 1905: 557. Flynn 1978: 7. Foenander 1952: 187. Groeneveldt 1938: 107. Hubback 1939a: 600, 604. Medway 1969: 103. Mukherjee 1974: 343. E.H. Peacock 1931: 448. Prater 1965: 223. Ridley 1901: 106. Sonne-Hansen 1972. van Strien 1974a: 43-44. Talbot 1960: 184. Thom 1935: 139, 140.

7.8.23 *Weapons*

Banks 1978: 226. Evans 1904: 161. Foenander 1952: 190. Schinz 1824.

7.9. REPRODUCTION

7.9.1 *General reports*

Ansell 1947: 252. Hubback 1939a: 601. van Strien 1974a: 47-49.

7.9.2 *Gestation*

Asdell 1964: 534. Burton 1962. Cheminaud 1939: 87. Foenander 1952: 188. Groves & Kurt 1972: 3. Lekagul & McNeely 1977: 652. Medway 1969: 104. Peacock 1933: 74. Smith 1935: 48. Tate 1947: 353.

7.9.3 *Mating season*

Asdell 1964: 534. Brasser 1926: 104. Smith 1935: 48.

7.10 PARASITES

Bequaert 1933: 140-142 (Malaya, *Amblyomma infestum* and *Hyalomma walckenaerii*). Hubback 1939a: 605 (flies and ticks). Krygsman 1933: 181 (nematode). Neumann 1901: 297 (*Amblyomma crenatum* from 'Sumatra' is probably African). Rodhain & Bequaert 1918: 439 (*Gyrostigma sumatrensis*). van Strien 1974a: 45 (review). Zumpt 1962 (*Gyrostigma sumatrensis*). 1965 (review).

7.11 VETERINARY STUDIES

Antonius 1937 (lung tuberculosis, inflammation of intestines). Coenraad-Uhlig 1933. Krumbiegel 1965 (nephritis). Lang 1976: 169 (anaemia, Basel zoo). Poulsen 1973 (cirrhosis of liver). Schlawe 1969: 28 ('vereiterter Lunge'). van Strien 1974a: 45 (review).

7.12 MUSEUM SPECIMENS

General: Brandt 1878a: 42 (Parsons 1743, pl. 3 figs. 4, 5 pictures horn of *D. sumatrensis*). Brookes 1828: 75 (private museum, 7 lots). Hooijer 1946a: 16 (material in Dutch museums). Rookmaaker 1977c: 58-59 (specimens imported from Borneo in the 19th century).

Amsterdam, Artis zoo museum: Portielje 1940: 43 (stuffed specimen).

Bangkok, Siamese museum: S. Flower 1900: 366.

Bogor, museum: Dammerman 1937 (stuffed head).

Brussels, Muséum Royal d'Histoire Naturelle: Friant 1948: 4 (skeleton).

Calcutta, Asiatic Society of Bengal: Asiatic Society 1816. Blyth 1847a (skin of head received), 1847b (skeleton and skull of 2 specimens), 1862a: 163, 1863b: 137 (list of specimens). Cantor 1846: 263 (head).

Calcutta, Indian Museum: W. Selater 1891: 204.

Calcutta, Zoological Survey of India: Chakraborty 1972: 124.

Chicago, Field Columbia museum: Elliot 1907: 105 (male, donated Franklin).

Copenhagen, University Zoological museum: Skafte 1964, pl. 3 (hide, skeleton).

Dublin, Trinity College: Blyth 1875: 53 (skull, shot by Oldham - *Note*: probably

- belongs to *R. unicornis*: specimen still present).
Kuching, Sarawak museum: Harrisson 1956: 269-270 (mounted foot, palang).
Leiden, Rijksmuseum van Natuurlijke Historie: Jentink 1887: 167, 1889: 25, 1892: 197, Loose 1975: 37.
London, British Museum (Natural History): Dollman 1928 (stuffed young, Perak). Gray 1862: 282, 1868: 1022, Groves 1965: 128, Loose 1975: 37, Mason 1882: 452 (2 skulls, Burma), Pocock 1928b (young, Perak).
London, Royal College of Surgeons: Flower & Garson 1884 (nos. 2141-2146). Gray 1868: 1022.
London, Zoological Society: Raffles 1830: 644 (one sent), Waterhouse 1838: 36 (one present).
Madrid, museum: Cabrera 1911: 140 (horn).
Munich, Zoologische Staatssammlung: Groves 1965: 128.
New York, American Museum of Natural History: Berger 1934: 97 (from Vernay 1933), Lang 1924c: 527 (2 specimens from Vernay, Burma).
Pahang museum: Hubback 1939a: pl. 1 (2 mounted heads).
Paris, Muséum National d'Histoire Naturelle: Cuvier 1836b, pl. 159, 160 (skull and skeleton sent by Diard and Duvaucel).
Perak museum: S. Flower 1900: 366 (heads).
Philadelphia, Academy of Natural Sciences: Miller 1942: 161 (no. 20242, Sumatra).
La Rochelle, Musée d'Histoire Naturelle: Groves 1967a: 235 (type *R. sumatrensis* G. Cuvier 1817).
Singapore, Raffles museum: Hanitsch 1908: 8 (1 stuffed animal, 2 skeletons). S. Flower 1900: 366.
Vienna, Naturhistorisches Museum: Groves 1965: 128.
Washington, United States National Museum: van Peenen 1969: 259 (no. 49561, Borneo).
Zürich, Eidg. Polytechnikum: Schneider 1906: 125 (skull and feet, Sumatra).

7. 13 EXHIBITION IN CAPTIVITY

7.13.1 Review

Flower 1931 (longevity). Groves & Kurt 1972: 4, Grzimek 1960a: 23, Kourist 1969b: 8, 1973: 139, Krumbiegel 1960: 13, Reynolds 1961a: 33-40 (list of all specimens, ca. 55), van Strien 1974a: 49.

7.13.2 General reports

Anon. 1967a (Kuala Lumpur zoo, wanted to catch 3 specimens but reconsidered after protest). Coenraad-Uhlig 1933 (Sumatra, young raised). Crandall 1968: 512. Hornaday 1885 (rhino offered on Singapore market for \$250). Hubback 1939a: 600 (Malaya, lived 7 years at 'To Raja Kiah). Krumbiegel 1960: 12, fig. 1 (Ehlbeck circus, 1895 in Germany). Lapham 1964 (Sumatra expedition 1959). Skaftø 1961, 1962, 1964 (Sumatra expedition 1959). Strickland 1968 (Kuala Lumpur zoo, against capture). Ullrich 1955 (Sumatra, young raised by Poser in 1928). Vernay 1924: 627 (Burma, young died en route to Rangoon). Census of rare animals, International Zoo Yearbook 6: 445, 7: 371, 8: 366, 9: 291, 10: 323, 11: 334, 12: 392.

7.13.3 American circus

Conover 1959: 5 (Adam Forepaugh 1873). Noack 1886: 138 (from Hagenbeck to

Barnum and Bailey, 1885). Reynolds 1967a: 290, fig. 5 (Ringling, 1902), 1968a: 7 (several specimens 1872-1906), 1970: 8-11 (several specimens 1872-1890). Sclater 1872d (to circus 1872).

7.13.4 Zoological gardens

- Amsterdam*: Rookmaaker 1977c: 57 (arr. 1896). Sclater 1896 (arr. 1896 from Borneo). Swierstra 1888: 19 (arr. 1881).
Antwerp: Gijzen 1960: 16 (arr. 1879). Peel 1903: 61.
Bangkok: Blyth 1862a: 168 (living in 1860).
Basel: Andersen 1963 (1959-1961). Grzimek 1960a: 23 (arr. July 1959). Krumbiegel 1965. Lang 1959. Reynolds 1968a: 6 (arr. 1959). Schlawe 1961: 94 (arr. 1959).
Berlin: Heck 1896: 1020 (drawing by G. Mützel). Klös 1969a: 72 (in 1874). Schlawe 1969: 28 (1878-1880).
Bogor: Andersen 1963 (1959-1961). Krumbiegel 1965 (arr. 1959). Medway 1972 (arr. 1959).
Budapest: Anon. 1895 (from Perak).
Calcutta: Anderson 1883: 74 (2 present). Buckland 1889a, b (birth 1889). Flower 1931: 203. Sanyal 1892 (3 received). Sclater 1884 (arr. 1882).
Cologne: Kohle 1981: 104 (between 1863 and 1900; and ca. 1936).
Copenhagen: Anon. 1972g (died 1972). Andersen 1963 (arr. 1959). Krumbiegel 1965. Poulsen 1973 (died 1972). Reynolds 1968a (arr. 1959). Rookmaaker 1973a (died 24.11.1972). Schlawe 1961: 94. Sonne-Hansen 1972 (1959-1972).
Hamburg: Bolau 1879: 110 (lived 4 years 2 months). Grzimek 1958: 120 (in 1886). Kourist 1969b: 8 (1872-1876), 1973: 139 (1872-1876, 1884). Noack 1886: 138 (mother and young to Barnum & Bailey circus, 1885). Noll 1873: 82 (in 1872). Rodhain & Bequaert 1918: 439 (no data). Sclater 1872c: 427 (in 1872), 1872d, 1873b (arr. 1872).
Leipzig: Anon. 1895 (one present). Rodhain & Bequaert 1918: 439 (no data).
London: Anderson 1872 (from Calcutta, 1872). Beddard & Treves 1889 (died 1885, 1888). Buckland 1872 (arr. 1872). Duncan 1892: 332 (arr. 1872). Flower 1908: 27, 1931: 203. Hood 1869 (captured 1867). Kourist 1973: 139 (1872-1900, 1886-1919). Loisel 1907: 16. Lydekker 1907a: 39 (arr. 1872). Manson 1876: 117 (captured 1867). Newman 1872a, c (arr. 1872). Noll 1873: 83 (arr. 1872). Scherren 1905: 160 (2 arr. 1872). Sclater 1872c, d, f (arr. 1872), 1876a: 651 (2 arr. 1872, 1875), 1878 (arr. 1878), 1879 (arr. 1879), 1885 (pair arr. 1885), 1886b: 266 (arr. 1886). Tun Yin 1967: 162 (1884-1886 from Bassein).
London, Docks: Bartlett 1873 (birth 1872). Noll 1873: 84 (birth 1872).
Madras: Flower 1914: 73 (arr. ca. 1890), 1931: 203.
Osaka: Sotani 1974 (arr. 1921).
Perth: Mayer 1922: 124-129 (caught Trengganu ca. 1902).
Philadelphia: Grzimek 1960a: 23 (2 died en route 1952).
Rangoon: Christopher 1916: 231 (one present). Flower 1914: 90 (arr. 1909). Tun Yin 1967: 162 (1909-alive in 1913).
Singapore (Botanic Gardens): Ridley 1901 (2 present), 1906: 161 (arr. 1875, 3 shipped to Vienna 1901). Wray 1905: 65 (captured in Dindings, sent to Singapore 1901).
Vienna: Antonius 1937 (1900-1908, 1902-ca. 1919). Boettger 1905: 376 (2 present). Giese 1962: 138 (2 present in 1902). Grzimek 1958: 120. Siedler 1905: 262 (2 seen, erroneously called *Rhinoceros bicornis*).
Washington: Baker 1896a, b (from Adam Forepaugh circus).

7.14 PHOTOGRAPHS

7.14.1 *Review*

van Strien 1974a: 72-73 (list of published pictures).

7.14.2 *Taken in the wild*

Ali & Santapau 1958b (Perak, as *R. sondaicus*). Borner 1979a, pl. 9 (photo Skafte, in wallow), pls. 2-8, 10-15 (rhino marks). Bruton 1963: 8 (photo Hubback). Foenander 1952, facing p. 177, 193 (photos Hubback). Grzimek 1958: 119 (photo G. Bazin, Perak). Hubback 1939a, b (photos made in Pahang). Khan 1962, 1971, pl. 42 (photo Game department, Malaya). Medway 1968b, pls. 9-11 (photo Game department, Malaya; track and rubbing marks). Metcalfe 1961, pl. 33 (photo G. Bazin, Perak). Peacock 1931 (male shot Shwe-U-Daung, 1930), 1933, pl. 6 (male shot Burma, 1930). Pfeffer 1963 (rhino in wallow, ?Borneo). Skafte 1961, 1962, 1964 (photos taken during Sumatra expedition 1959). Sody 1941, fig. 16 (photo Balai Poestaka, with 1 horn). Sumati 1976b: 6 (photo Milton, Malaya). Thom 1935, facing p. 137 (2 rhinos shot). Weatherbe 1939, facing p. 152, 155 (photos Hubback; tracks).

7.14.3 *Taken in captivity*

Copenhagen zoo: Borner 1974d. Groves & Kurt 1972, fig. 1 (photo Mohr). Hillenius 1971: 1461. Krumbiegel 1965, 6 figs. (6 photos 1964) Lukasiewicz 1962, fig. 2. Milton 1962, 2 figs. Reynolds 1968a, fig. 7 (photo Schlawe), 1970, fig. 4 (photo Mohr). Rookmaaker 1977c, pl. 4 (photo Schlawe 1961), 1982: 6. Schlawe 1961, 7 figs. Sonne-Hansen 1972, fig. 1. Stonehouse 1981: 64. van Strien 1974a: 5 (photo Mohr), 1978b. Tun Yin 1967 (photo Gee).

Basel zoo: Grzimek 1960a, fig. 2 (in 1959). Guggisberg 1966a, facing p. 129. Lang 1959. Lapham 1964: 66 (with Vikki Ryhiner). Sody 1959, fig. 13.

Bogor zoo: Medway 1972 (taken 1960), 1977, pl. 24b.

Other collections: Antonius 1937 (Vienna zoo). Christopher 1916, facing p. 228 (Rangoon zoo). Coenraad-Uhlig 1933, 5 figs. (Sumatra). Flower 1914, pl. 10 (Rangoon zoo). Jeannin 1962: 27 (unknown). Krumbiegel 1960, fig. 1 (Ehlbeck menagerie, drawing 1895). Lekagul & McNeely 1977: 656, 657. Reynolds 1970, fig. 3 (London, 19th century). Selous n.d.: 182, 188 (London, 2 figs.). Ullrich 1955 (Sumatra). Ullrich & Ullrich 1968: 253 (Sumatra).

7.14.4 *Photos of museum specimens*

Foenander 1952, pl. facing p. 192 (2 mounted heads). Groves 1967a, fig. 4 (5 skulls); 1971, figs. 14-17 (horns and heads). Harrison 1956, 1962 (horn Sarawak museum). Hubback 1939a, pl. 1 (2 mounted heads Pahang museum). Koffend 1974: 9 (mounted head, National museum Kuala Lumpur). Neuville 1927 (horns). Otto 1903, facing p. 138 (2 skulls, Sumatra). van Peenen 1969: 259 (Borneo skull). Prater 1965, pl. 55 (mounted head New York). Tun Yin 1967 (mounted animals New York).

CHAPTER 8

THE JAVAN RHINOCEROS, RHINOCEROS SONDAICUS

8.1 REVIEW

Hoogerwerf 1970. Loch 1937. Schenkel 1971. Schenkel & Schenkel 1969a. Sody (1941) 1959. Talbot 1960.

8.2 TAXONOMY AND NOMENCLATURE

8.2.1 *Revisions*

Brandt 1878a: 34-37 (*R. sondaicus* and *R. inermis*). Groves 1967a: 232-234 (*R. s. sondaicus*: Java; *R. s. floweri*: Sumatra; *R. s. inermis*, Sunderbans; other populations uncertain). Groves & Guérin 1980 (*R. s. floweri* synonymous with *R. s. sondaicus*, hence *R. s. sondaicus*: Java, Sumatra, Malaya; *R. s. inermis*: Sunderbans; *R. s. annamiticus*: Indo-China). Pocock 1946a: 309 (*R. s. sondaicus* and *R. s. inermis*).

8.2.2 *Remarks*

Blyth 1862a: 154-155 (existence of broad and narrow type in skulls, but variation not constant). Busk 1869: 413 (*R. nasalis*, *R. floweri* and '*R. stenorhynchus*' synonyms of *R. sondaicus*). Flower 1876: 450 (*R. floweri* and *R. nasalis* synonyms of *R. sondaicus*). Guérin 1980: 174-175 (differences between subspecies). Vageler 1927 (one-horned rhino shot by Hazewinkel on Sumatra is an -unnamed- 'völlig neue Varietät von *R. sondaicus*' - cf. Sody 1959: 162).

8.2.3 *Discovery by Petrus Camper*

Review: Rookmaaker & Visser 1982.

Remarks: de Blainville 1817: 165 ('*Rhinoceros de Camper*', possibly a variety of *R. sondaicus*). A.G. Camper 1809, 1811 (P. Camper's material from Java). P. Camper 1793 (distinction of 'beiden Asiatischen Gattungen von *Rhinoceros*'), 1803: 263 (Javan skull). Cuvier 1804b, 1812b, 1st pl. (Camper's Javan skull), 1836b, pl. 42 figs. 2, 4, 5 (skull, jaws of Javan specimen). Dawson 1958: 199 (letters by Camper to Banks 1786, 1787 about rhinoceros). Desmarest 1819: 243 (Camper's Javan skull). Geoffroy & F. Cuvier 1824. Gray 1868: 1009. Guggisberg 1966a: 114. Müller & Schlegel 1845: 183. Pallas 1780, pl. 9 (description of Javan skull parts). Schenkel & Schenkel 1969a: 98. von Schreber 1835: 309. Shaw 1800: 211 (Javan rhino figured by Pallas). Sody 1959: 131-132.

8.2.4 *Subspecies and synonyms of *Rhinoceros sondaicus**

Rhinoceros annamiticus Heude, 1892: 75, pl. XIXA figs. 1, 3, 4 (besides '*R. javanus*').

- Type-specimen: 3 teeth figured by Heude 1892 (cf. Groves & Guérin 1980, fig. 4).
 Type-locality: 'Cochin-chine' (Heude 1892).
 Remark: Groves & Guérin 1980 (*R. sondaicus annamiticus* described as subspecies of Indo-China).
 Taxon considered valid:
Rhinoceros annamiticus Heude 1892.
Rhinoceros sondaicus annamiticus: Groves & Guérin 1980.
- Rhinoceros camperii* Jardine, 1836: 181. Attributed to de Blainville 1817.
 Type-specimen and type-locality: not designated.
 Taxon considered valid:
Rhinoceros camperii Jardine 1836.
- Rhinoceros camperis* Griffith, [1826?] 1827: 290. Based on de Blainville 1817.
 Type-specimen and type-locality: not designated.
 Taxon considered valid:
Rhinoceros camperis Griffith 1827.
- Rhinoceros floweri* Gray, 1868: 1015, figs. 3, 4.
 Type-specimen: Royal College of Surgeons of England, London, no. 2934.
 Type-locality: Sumatra (Flower 1876: 450).
 Remarks: Busk 1869: 413 (synonym of *R. sondaicus*). Flower 1876: 450 (synonym of *R. sondaicus*). Groves 1967a: 234 (Sumatra).
 Taxon considered valid:
Rhinoceros floweri Gray 1868, 1869b. - von Martens 1876.
Rhinoceros sondaicus floweri: Groves 1967a. - Guérin 1980.
- Rhinoceros frontalis* von Martens, 1876: 257.
 Remarks: Rookmaaker 1977c: 53 (lapsus for *R. nasalis*). Sody 1959: 168 (lapsus for *R. nasalis*).
- Rhinoceros inermis* Lesson, 1838: 514.
 Type-specimen: Hornless female and young collected by Lamare-Picquot, first deposited in the Muséum National d'Histoire Naturelle, Paris (Geoffroy et al. 1831), in 1836 transferred to Berlin museum (Peters 1877). Skulls and skins of both specimens preserved in the Zoologisches Museum, Berlin, no. An. 10603 ('Typus' and 'Paratypus') - cf. Groves 1971, fig. 11.
 Type-locality: Bengal.
 Date: Groves 1967a: 234 (book dated 1840). Lesson 1842: 159 (mentions '*Rhinoceros inermis*, Lesson. Iles du Gange' without description). Pocock 1946a: 308 (Lesson's original description was not published until 1848). *Note*: I saw one copy of Lesson's book, in the library of the British Museum (Natural History), with the date 1838 on the title-page, a date also recorded by Brandt 1878a: 34 and Peters 1877.
 Remarks: Brehm 1877: 514 (synonym of *R. unicornis*). Ellerman & Morrison-Scott 1951: 340 (nomen nudum). Gray 1843: 186 (synonym of *R. unicornis*).
 Taxon considered valid:
Rhinoceros inermis Lesson 1838. - Brandt 1878a-c, 1879. Chenu & Desmarest 1858. Gervais 1855. Lesson 1842. Lydekker 1883. Peters 1877.
Rhinoceros sondaicus inermis: Sody 1941, fig. 17. - Groves 1967a. Groves & Guérin 1980. Guérin 1980. Kourist 1970. Pocock 1946a.

- Rhinoceros javanicus* Geoffroy-St. Hilaire & F. Cuvier, 1824: 2 ('Mon frère a donné à cette espèce le nom de Javanicus').
 Type-specimen: not designated.
 Type-locality: Java.
 Remark: Sody 1959: 133 (on the use of *R. javanicus*).
 Taxon considered valid:
Rhinoceros javanicus Geoffroy & Cuvier 1824. - Antonius 1914. Boitard 1842. Fromaget & Saurin 1936. Giebel 1855. Gloger 1841. Gray 1862, 1868, 1869b. Heck 1896. Jentink 1887, 1892. Lesson 1827, 1838. Lydekker 1880b, 1883. von Martens 1876. de Meyere 1894. Murray 1866. Oken 1838. Rainey 1878. Ridley 1901. Schlegel 1872. Vogt 1884.
- Rhinoceros javanus* Cuvier, 1829: 247.
 Type-specimen: not designated.
 Type-locality: Java.
 Remark: Sody 1959: 133 (use of *R. javanus*).
 Taxon considered valid:
Rhinoceros javanus Cuvier 1829. - de Blainville 1846. Cuvier 1836. Duvernoy 1854. Gervais 1855. Heude 1892. van der Hoeven 1855. Kaup 1833. Lenz 1835. von Martens 1850. Noll 1873. Schlegel 1857. von Schreber 1835.
- Rhinoceros nasalis* Gray, 1868: 1012, figs. 1, 2.
 Type specimen: British Museum (Natural History), nos. 723b (= 55.4.4.4) and 723c. Pocock 1945b, fig. 3A depicted mesopterygoid fossa of 723b.
 Type-locality: 'Borneo' (Gray 1868).
 Remarks: Busk 1869: 413 (synonym of *R. sondaicus*). Flower 1876: 450 (synonym of *R. sondaicus*). Groves 1967a: 234 (skull of *R. sondaicus*, possibly from Java). Medway 1977: 143-144 (skull from Java?). Rookmaaker 1977c: 53 (review).
 Taxon considered valid:
Rhinoceros nasalis Gray 1868, 1869b.
- Rhinoceros sondaicus* Desmarest, 1822: 399.
 Type-specimen: young animal sent to the Muséum National d'Histoire Naturelle, Paris by Pierre Diard and Alfred Duvaucel in 1821 (Desmarest 1822, Cuvier 1822: 24-27). Cuvier 1836b, pl. 55 figured the skeleton.
 Type-locality: 'Sumatra' (Desmarest 1822: 399), changed in supplement to 'Java' (Desmarest 1822: 547).
 Authorship: *R. sondaicus* was often attributed to Horsfield 1824.
 Remarks: Gray 1868: 1009 (accepts type-locality Java). Groves 1967a: 233 (type-locality Java). Raffles 1830: 719 (lists skeleton of rhinoceros in 'List of specimens required by Messrs. Diard and Duvaucel'). Sody 1946, 1959: 157 (Sumatra is correct type-locality because Diard and Duvaucel collected together only on Sumatra, not on Java).
 Taxon considered valid:
Ceratorhinus sondaicus: Steinmann & Döderlein 1890.
Rhinoceros sondaicus Desmarest 1822. - (*Note*: only 2 authors after 1900 use another name for the species; references until 1900 only are given) - Anderson 1889. Baker 1887. Ball 1877. Blanford 1891. Blyth 1862a, c. 1863b. 1872a, b. 1875. Brandt 1878a, b, c. 1879. Brehm 1877. Busk 1869. Cantor 1846. Chenu & Desmarest 1858. F. Cuvier 1825. Duncan 1892. Everett 1893. Falconer &

Cautley 1847. Fischer 1829. Flower 1876, 1891. Flower & Garson 1884. Fraser 1875. Fyche 1878. Gaebler 1883b. Garrod 1877a, b. Griffith 1827. Helfer 1838. Hooper 1910. Horsfield 1824, 1851. Jarnach 1875. Jardine 1836. Jentink 1895. Jerdon 1867. Lesson 1842. Mason 1882. Mohnike 1883. Müller & Schlegel 1845. Newman 1874. Nicholson & Lydekker 1889. Owen 1845. Pöppig 1851. Pollok 1879. Raffles 1830. Ridley 1895. Sanyal 1892. Schinz 1824 (for *sumatrensis*), 1845. Selater 1872c, 1873a, 1874, 1876b, 1877. W. Selater 1891. Sterndale 1884. Trouessart 1898. Ward 1896. Weinland 1862.

Rhinoceros sondaicus sondaicus: Groves 1967a. - Guérin 1980. Kourist 1970. *Rhinoceros* (*Rhinoceros*) *sondaicus*: Zittel 1891. - Friant 1950. de Pousargues 1904. Wroughton 1921.

Rhinoceros sondaicus: Le-Viet-Du 1969.

8.2.5 *Lapsus in names*

Rhinoceros javanensis, Hazewinkel 1932: vii. Barnard 1932: 185. Gray 1868: 1022. *Rhinoceros sanadaicus*, Stracey 1949: 470. *Rhinoceros sondaicus*, Bok 1940: 3, 4. *Rhinoceros sondaicus*, Morice 1875. Cordes 1881. van Kampen 1911. Koningsberger 1902. Laufer 1914. Vageler 1927. *Rhinoceros sondaicus*, Couperus 1887: 304.

8.2.6 *Lists of synonyms*

Ellerman & Morrison-Scott 1951: 340. Hooijer 1946a: 34-37. Lydekker 1916: 48.

8.3 NAMES IN VERNACULAR

Burma: Ansell 1947: 250. Blanford 1891. Burkill 1935. Evans 1905: 555. Peacock 1933: 77. Smith 1935: 46. Tun Yin 1967: 154. Wroughton 1915: 698.

India: Blanford 1891. Higgins 1935: 304 (Manipuri). Lydekker 1900: 26 (Nagas). Prater 1965: 231.

Indo-China: Bordeneuve 1925: 40. Bourret 1927: 62. Deuve & Deuve 1964: 28. Gairdner 1919: 125. Ho-Van-Cam 1947. Millet 1930: 187. Morice 1875: 20.

Indonesia: van Balen 1914: 213. Sody 1959: 125. Tjeenk Willink 1905: 201.

Java: Müller & Schlegel 1845: 190. Raffles 1830: 644. Sody 1938: 763.

Malaya: Ansell 1947: 250. Blanford 1891. Burkill 1935. Harrison 1974: 276. Loch 1937: 141. Medway 1969: 103. Metcalfe 1961: 183. Raffles 1830: 644. Wroughton 1915: 698.

Sumatra: Coomans de Ruiter 1948-49: 155. Hagen 1890: 105. Miller 1942: 162.

Thailand: Gairdner 1915: 136, 1919: 125.

8.4 EXTERNAL MORPHOLOGY

8.4.1 *Appearance*

Anon. 1935: 90. van Balen 1914: 212. Blanford 1891. Blyth 1872b: 3104. Boitard 1842: 405. Brandt 1878a: 36. Brehm 1877: 515. Bruton 1963. Carter et al. 1946: 151. Chenu & Desmarest 1858: 9. Crandall 1968: 506. Cuvier 1829: 247. Deuve & Deuve 1962: 99. Desmarest 1822: 399. Duncan 1892: 332. Fetherstonhaugh 1951a: 193. Flower 1900: 368. Foennander 1952: 180. Geoffroy & Cuvier 1824. Giebel 1855: 205. Grassé 1955: 1111. Guggisberg 1966a: 113. Hazewinkel 1932. Heck 1896: 1019. Horsfield 1824. Jardine 1836: 174. Kloss 1909: 36. Krumbiegel 1960: 13, 19.

Lekagul & McNeely 1977: 653. Lydekker 1907a: 35. Medway 1969: 103. Metcalfe 1961: 183. Mukherjee 1974: 342. Noll 1873: 54. Prater 1965: 231. Schinz 1824: 290. von Schreber 1835: 310. Smith 1935: 46. Sody 1959: 113. Stockley 1928: 100. Talbot 1960: 204. Tun Yin 1967: 154. Wood 1851: 755. Zeuner 1934: 32.

8.4.2 *Colour*

Blanford 1891. Flower 1900: 368. Koningsberger 1902: 60. Tjeenk Willink 1905: 201.

8.4.3 *Foetus*

Frechkop 1951 (with figures). de Meyere 1894: 375 (skin).

8.4.4 *Footprints*

Evans 1912: 560 (*R. sondaicus* larger than *D. sumatrensis*). Franck 1934: 77 (size). Harrison 1974: 276. Hoogerwerf 1950: 56 (size), 1970: 71, 83-85, 127 (size, method of measuring, individual variation). Kurt 1973: 67 (size). Lekagul & McNeely 1977: 652 (size). Schenkel & Schenkel 1969a: 127-129 (size). Sody 1936, 1937 (*R. sondaicus* larger than *D. sumatrensis*). van Strien 1978a (shape, size).

8.4.5 *Hair*

Cave 1969: 249. Groves 1967a: 222. Pocock 1914 (facial vibrissae absent, eye-lashes on upper eye lid). Sody 1959: 122. Tjeenk Willink 1905: 201 (young).

8.4.6 *Horn*

Franck 1935: 48. Groves 1971: 242. Neuville 1927.

8.4.7 *Horn measurements*

Dammerman 1937. Dollman 1928, 1937: 72. Franck 1934: 78 (Java). Groves 1971: 242, 246. Hoogerwerf 1970: 75. Koningsberger 1902: 60. Lydekker 1900: 27, 1907a: 35, 1907c: 73. Noll 1873: 54. O'Hara 1907: 385. Sody 1959: 116. Ward 1896: 283 (2 horns, Java).

8.4.8 *Horn in female*

Review: Groves 1971: 243-246.

Horn absent: Brandt 1878a: 36 (*R. inermis*). Dollman 1928. Fraser 1875 (Sunderbans). Geoffroy et al. 1831 (Sunderbans). Harmer 1921 (Tenasserim). Hazewinkel 1933 (Sumatra). Hoogerwerf 1970: 76 (Java, hump at most). Ho-Van-Cam 1947: 34 (Vietnam). Lamare-Picquot 1835: 58 (Sunderbans). Lydekker 1900: 27, 1907a: 26, 35, 1925: 178. de Monestrol 1925: 19 (Indochina). Neuville 1927: 189. de Poncins 1935 (Sunderbans). Rainey 1878 (Java, Sunderbans). Selater 1876b (Sunderbans). Smith 1935: 46 (Burma, often absent). Tate 1947: 354. Vageler 1927: 289 (Sumatra absent, Java small).

Horn present: Dollman 1932 (Malaya, rudimentary horn). Fischer 1829: 415. Kerkhoven 1926: 326 (Java, small horn). Schenkel & Schenkel 1969a: 130 (Java). Simon 1971 (both sexes same size horn).

8.4.9 *Size*

Anon. 1935: 90. van Balen 1914: 212. Blanford 1891. Blyth 1872b: 3104. Boitard 1842: 405. Brehm 1877: 515. Bruton 1963: 7. Chenu & Desmarest 1858: 9. Crandall 1968: 506. Desmarest 1822: 399. Finlayson 1950: 151. Franck 1934 (Java).

Guggisberg 1966a: 113. Harrison 1974: 276. Hazewinkel 1932: vii, 1933 (Sumatra). Hoogerwerf 1970: 74. Horsfield 1824. Jerdon 1867: 234. Koningsberger 1902: 60. Krumbiegel 1960: 19. Lekagul & McNeely 1977: 653. Noll 1873: 54. O'Hara 1907: 385. Prater 1965: 231. Schinz 1824: 205. von Schreber 1835: 313. Shekarea 1832: 314. Smith 1935: 46. Sody 1959: 116-119. Talbot 1960: 204. Tjeenk Willink 1905: 201. Wood 1851: 755.

8.4.10 *Skin*

de Meyere 1894 (foetus). Neuville 1927: 182.

8.4.11 *Age classes*

Schenkel & Schenkel 1969a: 126-129 (Ujung Kulon, based on footprints).

8.4.12 *Sexual dimorphism*

Guérin 1980: 157, 159 (female larger than male). Hoogerwerf 1970: 71 (female larger than male). Kerkhoven 1926: 327 (female larger than male). Pocock 1946c (marked external difference, slight difference in nasal bones).

8.5 ANATOMY

8.5.1 *General dissections*

Beddard & Treves 1887. Cave 1976b: 428 (history). Garrod 1877a. Grassé 1955: 1108-1118.

8.5.2 *Organs*

Brain: Mayer 1847: 61, pl. 7 fig. 2.

Caecum: Oppel 1897: 561.

Gall bladder: Oppel 1900: 977 (absent).

Intestines: Beddard 1902 (small intestine as taxonomic character). Oppel 1897: 561, 569.

Lymph: Cave & Aumonier 1964b (lymph node).

Pedal scent gland: Beddard 1902 (taxonomic character). Cave 1962a.

Reproductive organs: Disselhorst 1904: 317. Oudemans 1892: 57.

Stomach: Oppel 1896: 333.

Tongue: Sonntag 1922: 653.

8.6 OSTEOLOGY

8.6.1 *Skull*

Cave 1959: 2 (foramen ovale), 1965: 502 (lacrimal epiphysis). Chakraborty 1972 (occipital surface, foramen magnum, subaural channel). Finlayson 1950. Fraser 1875 (ossified nasal septum). Gray 1868: 1009. Groves & Guérin 1980: 203-204. Guérin 1980: 33-54. van der Maarel 1932: 73-75. Milne-Edwards 1868, pl. 13 (vertical section). Pocock 1944b: 834, fig. 1 (premaxillae), 1945a (nasal septum), 1945b, 1946c (nasal bones). Sody 1959: 121. Thenius 1955a (ossification of nasal septum).

8.6.2 *Skull measurements*

de Beaufort 1928. Blyth 1862a: 159. Carter & Hill 1942. Chakraborty 1972: 125.

Falconer 1868, I: 513, pl. 75. Gray 1868: 1032. Groves 1967a: 228, 236. Groves & Guérin 1980: 201. Guérin 1980: 48, 53. van der Maarel 1932 (16 skulls). Toulou 1902.

8.6.3 *Dentition*

Beden & Guérin 1973: 23 (size). de Blainville 1846: 43-58. Boitard 1842: 405. Chenu & Desmarest 1858: 7. F. Cuvier 1825, I: 219, II, fig. 90. Finlayson 1950. Flower 1876. Groves 1967a: 228 (size). Groves & Guérin 1980: 201, 204 (size, characteristics). Guérin 1980: 54-73 (description, size). Heude 1892: 74-75. Hooijer 1946a: 9 (distinction from *D. sumatrensis*), 1962b (shape, size). Lydekker 1880b: 140. van der Maarel 1932: 73, 77-80 (terms used in description). Owen 1845: 587. Pallas 1780, pl. 9 figs. 2, 3. Patte 1934. Pocock 1945b, 1946c (structure of pm², variation according to age and locality). Sody 1959: 123. Vrolik 1830: 384. Zeuner 1934: 32.

8.6.4 *Postcranial skeleton*

Beden & Guérin 1973: 24-41 (measurements of bones). Clutton-Brock 1965: 10 (scapula). Cuvier 1822: 29-36. Franck 1934: 78. Giebel 1851 (comparison with *R. tichorrhinus*), 1855, 205. Groves & Guérin 1980: 204-205 (description, size). Guérin 1980: 74-152 (descriptions and measurements of bones). Heller 1913: 13 (vertebral formula). Pouchet & Beauregard 1889: 198.

8.7 DISTRIBUTION AND STATUS

8.7.1 *Review*

Harper 1945. Sody 1959. Talbot 1960.

8.7.2 *General reports*

Anon. 1967h (status). Bruton 1963: 8. van Doren 1851: 224 (hunting). Guggisberg 1966a: 116. Harper 1945: 390 (status). Heck 1896: 1019. Krumbiegel 1960: 16. Loch 1937: 130. Lydekker 1907a: 37. Mukherjee 1974: 342 (map). Schenkel & Lang 1969: I. von Schreber 1835: 315. Sody 1959: 177 (status). Spinage 1962: 79 (map). Talbot 1960: 207 (map).

8.7.3 *Bhutan*

Kinloch 1904: 65 (Bhutan Duars).

8.7.4 *Burma*

Review: Harper 1945: 382. Sody 1959: 173. Tun Yin 1954b, 1967: 155.

Hunting: Pollok 1879, I: 95.

Legislation: Ansell 1947: 254-256. Tun Yin 1954b, 1967: 156.

'Burma' only: Anon. 1935: 90. Blanford 1891. Blyth 1862a: 151. Bourret 1927: 62. Carter et al. 1946: 151. Crandall 1968: 505. Dollman 1937: 72. Evans 1912: 122. Flower 1900: 368. Grzimek 1958: 118. Hanitsch 1908: 8. Jerdon 1867: 234. Kirk 1968: 150. Kloss 1927: 207. Lydekker 1892a, 1900: 27, 1925: 177. Polo 1958: 188 (unicorn in Mien). Prater 1965: 231. Selous n.d.: 182. Shebbeare & Roy 1948: 89. Sterndale 1884: 410. Stockley 1928: 101. Tate 1947: 354. Tjeenk Willink 1905: 203. Ward 1896: 283.

Records: Blyth 1862a: 169 (Shan hills east of Ava, may be one-horned). Burton 1951: 729 (virtually extinct). Evans 1905: 557 (upper and lower Burma, *D. sumatrensis* more frequent than *R. sondaicus*). Fytche 1878, I: 103 (Sandoway dt.). Hobbly 1932 (Kahilu and Schwe-U-Daung reserves). Maliepaard & de Vos

1961: 95 (possibly in south). Milton 1961: 106 (status). Peacock 1931: 447 (Schwe-U-Daung, tracks 8½" diameter), 1933: 78-79 (Thaton, Salween and Mergui subdivisions, Victoria Point subdivision, possibly Kahilu reserve). Pollok 1879, 1: 98 (into Arrakan). Reynolds 1954 (status). Smith 1935: 47 (Thaton, Salween and Mergui dts.). Thom 1943: 257 (R. sondaicus never personally observed). Tun Yin 1954b (now only *D. sumatrensis* reported).

Tenasserim: Anderson 1889: 333. Berg 1933: 122 (still 4 in Salween dt.). Blyth 1842: 448 (south of Ye), 1862c (Tavoy Point, skull), 1869c (Tavoy Point, skull), 1875: 51. Fitter 1968: 58. Groves 1967a: 224. Guggisberg 1966a: 119. Gyldenstolpe 1916: 51 (Bankachon, shot by Shortridge). Heller 1838: 860. Loch 1937: 133 (Victoria Point, shot by Hubback 1920). Low 1836: 50, fig. 2 (species unclear). Mason 1882: 451. Milton & Estes 1963: 63. Schenkel & Schenkel 1969a: 99 (Hubback 1920). Shortridge 1915: 772 (Victoria Point, skull; *D. sumatrensis* and *R. sondaicus* equally numerous). Tate 1947: 354 (Thaton, 1943). Tun Yin 1954a: 83 (Kyaiktiyo hill, until ca. 1949, possibly *R. sondaicus*), 1954c: 302 (several areas in Tenasserim, species uncertain), 1955a: 257 (Tenasserim Yoma, N. Tavoy dt., shot Jan. 1954), 1967: 155 (localities in Tenasserim). Wroughton 1915: 698.

Kahilu Game Reserve: Ansell 1947: 264-266 (review, 'was one of the last refuges in Burma, on the evidence of the skulls'). Blanford 1939. Hubback 1939a: 161 (possibly *R. sondaicus*). Loch 1937: 133. Schenkel & Schenkel 1969a: 99 (in 1930). Thom 1935: 138 (6 specimens, almost certainly *R. sondaicus*), 1943: 257 (skull in Bombay natural history society). Weatherbe 1939 (*R. sondaicus*, doubtful).

8.7.5 China

All records on the distribution of the rhinoceros in China are given here while it is unknown what species (*R. sondaicus* or *R. unicornis* or *D. sumatrensis*) are involved.

Review: Jenyns 1955: 35-38. Laufer 1914: 106, 118, 133, 136, 149, 159, 160, 161-166. Rookmaaker 1980b: 259-260. van Strien 1974a: 25. Talbot 1960: 205.

Records: Allen 1940, II: 1279 (no evidence from south in historic times except vague reports). Bishop 1933: 326 (exterminated in north in 2nd century). Blyth 1862a: 151 (*R. sondaicus* or *D. sumatrensis*), 1872b: 3108, 1875: 51. Brandt 1878a: 37 (Kwangsi). Bushell 1904: 119 (Yunnan). Chang 1926 (former occurrence in north). Dapper 1670: 230 (Chucheufu, Suchuen). Duhalde 1736: 243 (Kwangsi). Erkes 1916: 64 (south, according to Huai-nan-tze, ca. 122 B.C.). Hubback 1939a: 596 (Mongle, 22° 30'N, 102° E., as *D. sumatrensis*). Imbert 1921: 220 (Kwangsi). Krumbiegel 1928 (middle and south China). Loch 1937: 145 (areas bordering Burma and Tonkin). Marshall 1900: 73. Richard 1908: 198, 206 (Kwangsi, Kwantung). Schenkel & Schenkel 1969a: 99 (formerly S.W. China). Sody 1959: 173 (one report from Hainan island). Sowerby 1939: 8 (China in Chou or Han dynasty). Sterndale 1884: 410 (W. province).

8.7.6 India and Bangladesh

Review: Harper 1945: 381-382. Mukherjee 1974: 343. Rookmaaker 1980b: 254-258. Sody 1959: 174-177. Talbot 1960: 204-205.

Hunting: Baker 1887: 279. Simson 1886: 188-192.

Legislation: Bengal government 1932.

'India' only: Anon. 1935: 90. Carter et al. 1946: 151. Dollman 1937: 72. Duncan 1892: 332. Hanitsch 1908: 8. Kirk 1968: 150. Noll 1873: 54. Selater 1872c: 426. Tate 1947: 354. Ward 1896: 283.

Records: Ball 1877: 170 (Jerdon's record of Mahanadi river incorrect, maybe based

on captive animal). Blanford 1891. Blyth 1862a: 151 (Rajmahal hills), 1872b: 3107 (old records from continental India refer to *R. sondaicus*), 1875: 50 (Garo hills; eastern and lower Bengal). Brandt 1878a: 37 (Rajmahal hills). Burton 1951 (Chittagong). Cockburn 1883: 63 (Garo, Khassia and Naga hills). Flower 1900: 368 (Assam, Sikkim, Bengal). Gee 1948b: 64 (Sona Rupa, Assam, *R. sondaicus* or *D. sumatrensis*). Groves 1967a: 224 (localities). Grzimek 1958: 118. Higgins 1935: 304 (R. Khuga 1913: lower valley of R. Barak; Lushai hills). Inglis et al. 1919: 825 (Jalpaiguri dt.). Jerdon 1867: 234 (near Calcutta; Rajmahal hills; along Mahanuddy river, Orissa). Loch 1937: 132. Lydekker 1892a (Assam), 1900: 27 (Assam, Sikkim, Chittagong, Bengal), 1907a: 36 (Sikkim), 1925: 177 (Assam, Bengal). Milroy 1935: 102 (Bengal Dooars). Murray 1866: 338 (Rajmahal). Pollok 1879, 1: 98 (Assam, Garrow hills, Sylhet, Tipperah, Chittagong). Prater 1965: 231. Schenkel & Schenkel 1969a: 99 (Assam). Shebbeare 1935: 1229 (Bengal), 1953: 141 (Assam south of Brahmaputra; Bengal; Sikkim; Rajmahal hills until 1850). Shebbeare & Roy 1948: 89 (Chittagong). Sterndale 1884: 410 (localities). Stockley 1928: 101 (Assam, Sikkim). Stracey 1949: 470 (Assam until 1874). Wood 1930: 60, 69 (Tipperah, Sylhet, Lushai).

Sunderbans: Baker 1887: 279-284 (1 shot). Blyth 1862a: 151, 1863a: 156, 1872b: 3106 (1 shot 1860), 1875: 50. Brandt 1878a: 37. Burton 1951 (extinct 1892). Flower 1900: 368. Foenerander 1952: 180 (lower Brahmaputra, until ca. 1890). Gee 1964: 157 (until 1900). Groves 1971: 243 (localities). Guggisberg 1966a: 118. Kinloch 1904: 65. Lamare-Picquot 1835: 54-60. Lydekker 1892a, 1925: 177. Maliepaard & de Vos 1961: 95. Murray 1866: 338. de Poncins 1935 (around Pizum Khalee river, 1892). Schenkel & Schenkel 1969a: 99. Selater 1876b (Ray Mangal river, captured 1876). Selous n.d.: 182. Shekarea 1832 (Saugor island). Simson 1886: 188 (seashore). Stockley 1928: 101.

8.7.7 Indochinese region

All records on the distribution of the rhinoceros in the Indochinese countries are listed here, both referring to *R. sondaicus* and to *D. sumatrensis*.

Review: Guggisberg 1966a: 105, 120. Harper 1945: 384-387 (many localities). Loch 1937: 142-145. Rookmaaker 1980b: 260-264. Sody 1959: 172-173. van Strien 1974a: 25. Talbot 1960: 179.

Hunting: Fraisse 1955: 111-112. Millet 1930: 189. Mouhot 1864: 147.

'Indo-China' only: Blyth 1863a: 156. Bock 1884: 294. Carter et al. 1946: 151, 153. Crandall 1968: 505. Foenerander 1952: 183. Hubback 1939a: 594. Imbert 1921. Kirk 1968: 250. Medway 1969: 103. Schenkel & Schenkel 1969a: 99. Shebbeare 1953: 145. Street 1961: 108, 110. Strickland 1967: 1. Tate 1947: 354.

General records: Blyth 1862a: 168. Borner 1979a: 66. Borri 1633, cap. 4 (hunt in Cochin-China). Bourret 1927: 62. Chochod 1950: 92. Crawford 1828: 478. G. Grandidier in Sauvaire 1930: 246 (*R. sondaicus* and *R. unicornis*). Fraisse 1955: 113 (species hêt and sou, *R. sondaicus* and *R. unicornis*). Groves 1967a: 223 (*D. sumatrensis* practically unknown, *R. sondaicus* from several areas). Groves & Kurt 1972: 2 (2 reports for *D. sumatrensis*). Laurie & Olivier 1977: 660 (two species). McNeely & Laurie 1977 (all countries, *R. sondaicus*). Maliepaard & de Vos 1961: 95, 97 (no reports). Millet 1930: 187 (localities). de Monestrol 1925: 19-21, 81 (one-horned only, '*R. indicus*'). Patte 1934: 778 (two species). de Pousargues 1904: 535 (Cambodia to Cochin-China, *R. sondaicus*). Roussel 1913: 251-256 (all countries, 4 seen; Suoi-Ghia-Nhan). Sauvaire 1930: 131, 135 (*D. sumatrensis* near coast, *R. sondaicus* in mountains). Strickland 1967: 1 (*D. sumatrensis*).

Kampuchea (Cambodia): Anon. 1963c (status). Brandt 1878a: 37. Bordeneuve 1925: 40 (localities). Fitter 1968: 58 (status, *D. sumatrensis*). Garnier 1873: 222 (left bank of Mekong). McNeely & Laurie 1977 (south). Mouhot 1966: 70 (west). Moura 1883, 1: 66. Murray 1866: 338. Pelliot 1902: 166, 169 (Cambodia according to Tcheou Ta-kouan, Yuan dynasty). Quiroga de San Antonio (1604) in Cabaton 1914: 94. Simon 1966, 1967. Stöner 1925 (Angkor Vat).

Laos: Boutin 1937: 114 (prov. Houa-Phan). Cheminaud 1939. Colonna 1938: 112 (prov. Saravane, not seen since 1930). da Cruz (1569-70) in Boxer 1953: 77. Delacour 1940: 56 (Lao-Bao, Nong-het, *D. sumatrensis*; south, *R. sondaicus*), 1966: 95, 114 (Quang Tri, 1920's; Nonghet, skull *D. sumatrensis*). Deuve & Deuve 1962 (localities 1900-1961), 1964: 28 (localities for *R. sondaicus*; other species probably absent). Fraisse 1955: 111-112 (Chup, Dak Rao, Mam Ray). Gyldenstolpe 1919b: 170 (two-horned). Mouhot 1864: 147-148 (Louang Prabang, possibly *R. sondaicus*-cf. Hubback 1939a: 596). Neese 1975, 1976a, b (localities on Laos/ Cambodia border, *R. sondaicus*). Sauvire 1930: 143-149 (Xieng-Khouang 1896). Simon 1967 (north in 1960's, *R. sondaicus*).

Vietnam: Brentjes 1973: 254 (Chinese knew 'one-horn' from N. Vietnam). Carletti (1701) 1964: 159. Constable 1982: 250, 253 (Dalat, 1963; Blao). Deveria 1880: 41, 88 (horns to China). Ho-Van-Cam 1947: 34 (*R. sondaicus* and *D. sumatrensis*). Le-Viet-Du 1969 (*R. sondaicus* disappeared). Milne Edwards 1896 (Bien Hoa, skull to Paris Natural History museum, *R. sondaicus*). Morice 1875: 20-43 (one-horned), 1876: 32, 37, 42 (Phuquoc island, legendary animal; near Tayninh). Nguyen-van-Hiep 1963 (localities, 2 species). van Peenen 1969: 260 (localities, 2 species). Pham-hoang-Hô 1968: 407. Phily 1934: 283 (*R. sondaicus* killed for horn). Prater 1965: 232 (*D. sumatrensis*). Sauvire 1930: 135 (lac Mercier, 1904).

8.7.8 Java

Review: Guggisberg 1966a: 121-123. Harper 1945: 388-390. Hoogerwerf 1970: 48-52. Sody 1959: 125-157.

Hunting: van Balen 1914: 214, 217. de Beauvoir 1870: 49-58. Epp 1852: 380. Franck 1935: 45. Kerkhoven 1926: 328. Roorda van Eysinga 1843.

Legislation: Basjarudin 1967. van Bommel 1969: 70-73 (in 1930's). Hoogerwerf 1970: 58-62 (review). van Imhoff 1888: 479 (premium for killing rhino in 1747, withdrawn 1749). Kerkhoven 1916: 367. Olivier 1916: 156.

Records: Appelman 1930: 583 (Bantam, Preanger), 1934 (Karangnoenggal 1918, Tasikmalaja 1934). Blume 1825: 59 (Gedeh), 1845 (Mt. Kendang 1822). Boie 1832: 117 (Tjitarum). Brongersma 1937: 250 (Slamat, formerly further eastward). Buddingh 1859: 61 (Mt. Kendang). Buys 1900: 173 (Mt. Galocnggoeng island 1834). der Chijs 1889: 289 (*R. Craoan* 1661). Cordes 1881: 103-104 (Mt. Slamet is eastern boundary, strays in Ngawen dt. and Kediri residency). Couperus 1887: 304 (rarely east of Slamet). Dammerman 1929b: 7 (status). Doeters van Leeuwen 1933: 74 (formerly Mt. Pangrango). Epp 1852: 357 (Slamat). Franck 1935: 50 (between Tjikandang and Tjikaingan). Gelpke 1838: 61, 69 (Nousakambangan island 1834). van Gorkum 1865: 250 (Tangkoban-Praoe). Groves 1967a: 224. de Haan 1911: 31 (Oetan badak). Hacckel 1901: 121 (Gedeh, Salat). Harmer 1922: 16 (status). Hazewinkel 1936: ii (Tasikmalaja 1934). Heynsius-Viruly & van Heurn 1935: 43, 46. van Hoëvell 1860 (Tjermei). Horsfield 1824 (Tangung, Priangan). van Imhoff 1888: 479, 598 (1746-1747 60 rhinos killed; 1747-1749 526 rhinos killed). Jagor 1866: 206 (Slamat most eastern locality). Junghuhn 1866: 236 (Tji-Ikal).

Kerkhoven 1916: 368 (Preanger river). Koningsberger 1902: 1 (S.W.). Loch 1937: 141 (Tasikmalaja; Bantam). Lörzing 1917: 83 (Patocha). Maliepaard & de Vos 1961: 94 (Preanger). von Martens 1876: 257 (Preanger). Müller & Schlegel 1845: 187, 189 (Tjikau, Mt. Malabar). Nagel 1828: 45, 1829: 76 (Tjerimai). van Oort & Müller 1833: 85, 87, 116, 134 (Tangkoebang Prahee, Tjeloctok, Mt. Patoeka, in Preanger). Reinwardt 1822: 34 (Mt. Papandayang, Mt. Talaga Bodar). Roorda van Eysinga 1831, II: 407 (Salak). P. Roorda van Eysinga 1843: 95 (Preanger 1821). Schenkel & Schenkel 1969a: 99 (Preanger). Talbot 1960: 205 (status). Taman 1961 (*R. Bantam*). Verhuell 1836: 125 (Mt. Pontianak). Veth 1882: 303 (Gedeh).

Ujung Kulon National Park: Anon. 1963c (status); 19711 (animal seen); 1972b, c, 1973g, 1974c, 1977b (status). Adams 1861: 7328 (Mew Bay, many tracks). Ammann 1979a, b, 1980 (status). Angst 1973 (one seen in 1970). Basjarudin 1968: 390. Bernard 1930 (poaching). Bruton 1963: 8. Coolidge 1964: 33. Dollman 1937: 72 (status). Fitter 1968: 58, 1974b: 72 (status). Franck 1935. Geroudet 1968. Grzimek 1958: 119, 1960a: 25 (status). Guggisberg 1966a: 125 (status). Hoogerwerf 1937 (animals seen, poaching), 1938: 86 (protection), 1939a, 1946: 206, 1950: 55-58 (status), 1954: 224 (status), 1970: 63-69 (poaching), 70-72 (status), 153-156 (protection). Kerkhoven 1926: 326. Kirk 1968: 150. Koesnadi 1961: 114. Laurie & Olivier 1977: 660. Loch 1937: 141. Maliepaard & de Vos 1961: 94. Moss et al. 1981 (status). Pfeffer 1958: 130. Prater 1965: 231. Ripley 1966: 148. Schaurte 1968: 285. Scheygrond 1973. Schenkel 1971, 1979, 1980. Schenkel & Schenkel 1968a, b, 1969a: 97, 1970b, 1972b, 1974, 1975, 1977, 1978, 1980 (status). Schenkel et al. 1978 (management). Shebbeare 1953: 146. Somberg 1968 (one seen). Stonehouse 1981: 64. Street 1961: 108. Taman 1961. de Voogd & Siccamo 1939: 51 (poaching in 1935-36). WWF 1967, 1968, 1971a, 1972.

8.7.9 Malaya

Review: Harper 1945: 386. Loch 1937: 135-140 (10 records 1816-1932, most west coast, one Pahang). Metcalfe 1961: 185. Sody 1959: 169-171.

Hunting: O'Hara 1907. See also at *D. sumatrensis*, 7.7.7.

'Malaya' only: Anon. 1851, 1935: 90. de Beaufort 1926: 60. Blanford 1891. Blyth 1863a: 156, 1875: 51. Brandt 1878a: 37. Cantor 1846: 262. Carter et al. 1946: 151. Chasen 1940: 207. Crandall 1968: 505. Dammerman 1924: 342, 1929a: 34. Delsman 1951: 80. Duncan 1892: 332. Flower 1900: 368. Hanitsch 1908: 8. Jerdon 1867: 134. Kirk 1968: 150. Kloss 1906: 148, 1909: 36. Lydekker 1892a, 1900: 27, 1925: 177. Medway & Balasingan 1968: 465. Murray 1866: 338. Prater 1965: 231. Raven 1935: 261. Ridley 1895: 161, 1901: 105. Sclater 1872c: 426, 1873a: 140. Sterndale 1884: 410. Selous n.d.: 182. Stockley 1928: 101. Tate 1947: 354. Ward 1896: 283.

Records: Barbour & Allen 1932: 145 (Pinjih valley 1899, Kuala Serukoi 1924). Barnard 1932 (*R. Palawan* 1898, Batu Gaja 1897, unidentified). Bequaert 1933: 137 (Teluk Anson, Perak). Berger 1934: 97 (not found by Vernay). Blyth 1862a: 152 (9 killed in south). Burgess 1935: 250 (1 shot by Barnard 1901-02), 1951 (ulu R. Seduli, Johor). Comyn-Platt 1937a: 48 (Perak only). Dollman 1937: 72 (status). Enriquez 1927: 73 (Taiping, Perak 1925). Fetherstonhaugh 1951a. Flower 1900: 367 (localities). Foenander 1952: 180 (Perak 1932; uncertain in Pahang 1891). Groves 1967a: 224 (localities). Grzimek 1958: 118 (Bernam, Perak ca. 1930). Guggisberg 1966a: 120 (west only). Harrison 1974: 276 (west coast; Pinjih valley, Perak 1874). Hislop 1968: 278 (absent). Hubback 1926: 39, 40 (lower Perak). Kloss 1927 (Pinjih valley, Perak 1899; Kuala Serukoi, Perak 1924), 1931 (*R. Pelawan*, Perak, shot by H.C. Barnard 1898; Ujong Permatang, Selangor 1927). Koffend 1974: 10 (Perak 1932).

Maliepaard & de Vos 1961: 94 (possibly extinct). Medway 1969: 103 (formerly Prov. Wellesley, Perak, Pahang, Selangor; tracks Johor 1949). Morris 1936 (not seen). Schenkel & Schenkel 1969a: 99 (Malaya 1932). Scott 1975 (extinct ca. 1945). Shebbear 1953: 146 (ulu Bernam, Perak). Strickland 1967: 1, 3 (Perak, last shot 1932; formerly R. Dusun, Selangor). Wycherley 1969: 146 (last shot 1932).

Note: Picture taken on Lima Bilas oil estate, Slim River, Perak in 1958, thought to represent *R. sondaicus*, shows a *D. sumatrensis*-see 7.7.7.

8.7.10 Sumatra

Note: All reports in which the species is not explicitly stated to be *R. sondaicus* are listed under *D. sumatrensis* (7.7.8).

Review: de Beaufort 1928. Franck 1935: 49. Guggisberg 1966a: 115, 117, 121. Harper 1945: 387. Heynsius-Viruly & van Heurn 1935. Hoogerwerf 1970: 47. Hooijer 1945: 249-252. 1946a: 6-9. Loch 1937: 141. Sody 1959: 157-167. Talbot 1960: 205.

Hunting: Volz 1912. See also *D. sumatrensis*, 7.7.8.

Legislation: Basjarudin 1967. van Bemmelen 1969: 70-73. Hoogerwerf 1970: 58-62. Olivier 1916: 156.

'Sumatra' only: Barbour & Allen 1932: 145. de Beaufort 1926: 60. Blanford 1891. Blyth 1842: 449, 1875: 51. Brandt 1878a: 37. Busk 1869: 415. Carter et al. 1946: 151. Chasen 1940: 207. Crandall 1968: 505. Dammerman 1929b: 34. Delsman 1951: 80. Desmarest 1822: 399. Flower 1876: 450. Flower 1900: 368. Gray 1868. Griffith 1827: 290. Hagen 1890: 105. Hanitsch 1908: 8. Kirk 1968: 150. Kloss 1927: 207. Lydekker 1892a, 1900: 27, 1925: 177. Maass 1917: 231. Marsden 1811: 116. Medway 1969: 103. Noll 1873: 54. Prater 1965: 231. Raven 1935: 261. Robinson & Kloss 1923: 317. Sclater 1872c: 426. Selous n.d.: 182. Shaw 1800: 200. Shebbear & Roy 1948: 89. Sowerby 1930: 218. Sterndale 1884: 410. Tate 1947: 354. Tjeenk Willink 1905: 203. Ward 1896: 283.

Absence stated: van Bemmelen 1915: 92. Blyth 1862a: 152. Dammerman 1924: 342. Harmer 1922: 16. Jentink 1895. van Kampen 1911: 551. Temminck 1835: viii.

Records: Anon. 1937b: 560 (Lampung). de Beaufort 1928 (250 km S.W. Palembang). Carpenter 1938: 62 (localities in Aceh). Coomans de Ruiter 1948-49: 156 (S. Sumatra doubtful). Dollman 1937: 72 (status). Groves 1967a: 224 (localities). Grzimek 1958: 118 (exterminated in 1934). Hamerster 1926: 39 (R. Koealoe). Hazewinkel 1932 (7 shot in S. Sumatra), 1933 (Ogan and Kommering ulu, Palembang residency, 7 shot 1925-26). Heynsius-Viruly & van Heurn 1935: 43, 46 (Palembang; Aceh). Hoogerwerf 1939b: 282 (Aceh), 1954: 224 (last shot 1934). Hoogerwerf & van Steenis 1936: 52 (Way Kambas, Lampung). Kreemer 1922: 193 (Aceh). Kurt 1973: 68 (map; possibly in Gunung Leuser N.P.). Lekkerkerker 1916: 93, 109 (Aceh). Maliepaard & de Vos 1961: 94. Miller 1942: 161 (Aceh, near west coast). Neumann 1885: 123 (R. Pane, R. Bila). Schenkel & Schenkel 1969a: 99 (reports 1925-1930), 1972b (possibly in Gunung Leuser N.P.). Scheygrond 1971: 43, 1972: 201 (Gunung Leuser N.P., uncertain). Schilling 1952, fig. facing p. 49 (Gajohlanden, incorrectly identified as *D. sumatrensis*). Simon 1966, 1967, 1971 (status). van Strien 1974a: 18 (Gunung Leuser N.P. uncertain). Vageler 1927 (south). Volz 1912: 236, 239, 243 (Goldberg, Aceh, shot 1904). WWF 1972 (Gunung Leuser N.P.).

8.7.11 Thailand

Review: Harper 1945: 383. Sody 1959: 171-172.

'Thailand' only: Bourret 1927: 62. Brandt 1878a: 37. Carter et al. 1946: 151. Crandall 1968: 505. Dollman 1937: 72. Flower 1900: 368. Hatting 1967: 156, 164. Kirk 1968: 150. Murray 1866: 338. de Pousargues 1904: 548. Schenkel & Schenkel 1969a: 99. Suvatti 1950: 587. Tate 1947: 354.

Records: Bradley 1876: 95, 122, 183, 201 (R. MacNam 1869-70, once as one-horned). Cheminaud 1939: 87-94 (Xieng Sen, one shot). Deuve & Deuve 1962: 101 (Xieng Sen, one caught 1938). W.W. Fegan in Loch 1937: 133 (near Three Pagodas, Meklong, Krabin prov.). Gairdner 1915: 136 (Ratburi and Petchaburi dts., two names). Groves 1967a: 224 (localities). Gyldenstolpe 1914: 29 (*R. sondaicus* more common than *D. sumatrensis*), 1916: 51, 1919b: 170 (south and along western frontier; erroneously recorded under *D. sumatrensis*). Kloss 1927: 207 (between Tenasserim and Malaya). Lekagul 1963 (Karnchanaburi dt. seen 1958-1961), 1968: 267 (south). Lekagul & McNeely 1977: 653. Low 1836: 44 (Kedah, unidentified). McNeely & Cronin 1972 (still possibly Tenasserim, Krabi and Trang provinces). McNeely & Laurie 1977 (Tenasserim 1976, vague reports from south).

8.7.12 Unlikely reports

8.7.12.1 Borneo

Presence of *R. sondaicus* on Borneo was often asserted: reviewed by Harper 1945: 389, Loch 1937: 145, Medway 1977: 144, Rookmaaker 1977c and Sody 1959: 167.

Presence stated: Bartlett 1874: 499. Blanford 1891. Blyth 1862a: 151, 152, 1863a: 157, 1863b: 137, 1875: 50. Brandt 1878a: 37. Busk 1869: 415. Deuve & Deuve 1962: 100. Flower 1900: 368. Flower & Lydekker 1891: 405. Frechkop 1951: 1. Gray 1868: 1012. Hanitsch 1908: 8. Harper 1945: 389. Jerdon 1867: 234. Lydekker 1892a, 1900: 27, 1907a: 35, 1925: 177. Mohnike 1883: 420. Müller 1840: 39. Noll 1873: 54. Raven 1935: 261. Sclater 1872c: 426, 1873a. W. Sclater 1891: 203. Selous n.d.: 182. Sowerby 1930: 218. Sterndale 1884: 410. Tjeenk Willink 1905: 203. Wallace 1876, 11: 213. Ward 1896: 283. Weinland 1862: 128. Wroughton 1921: 311.

Absence stated: Everett 1893. Flower 1876. Jentink 1884, 1895. Murray 1868a.

8.7.12.2 New Guinea

Presence asserted by Meyer 1875 and Walker 1875 (dung seen). Discussed by Harting 1875. Denied by Heptner 1960 and Sody 1959: 168.

8.7.12.3 Sulawesi (Celebes)

Basjarudin 1968: 392 (presence in Bati Murung, Celebes).

8.7.12.4 Sumba islands

Mertens 1930: 24 (Lombok, Sumbawa, and Flores).

8.7.13 Prehistoric occurrence

General: Hooijer 1946a: 38-81; 1946b (evolution of skeleton pleistocene to recent), 1949 (evolution of skeleton, Java and Sumatra).

Indo-China: Arambourg & Fromaget 1938: 793 (*R. sumatrensis* holocene, *R. sivalensis* quaternary). Beden & Guérin 1973: 19-46 (Cambodia, Phnom Loang, description of *Rhinoceros sondaicus guthi*). Beden et al. 1972: 113-114 (Cambodia, Phnom Loang, pleistocene remains referred to '*Rhinoceros sondaicus guthi* Guérin 1972'). Fromaget & Saurin 1936 (neolithic). Groves & Guérin 1980: 206 (review). Guérin 1980: 170 (comparison of recent *R. sondaicus* with *R.s. guthi*). Guérin & Mourer 1969 (Cambodia, neolithic). Patte 1934 (Vietnam, uncertain species).

Java: Bok 1940: 3-5 (pleistocene). Dammerman 1934a: 232, 1934b: 479, 482 (Sampung cave, 1000 B.C.). Dubois 1908: 1245, 1258 (Kendeng fauna, description of *Rhinoceros sivasondaicus*). Hooijer 1946a: 54 (*R. sivasondaicus* synonym of *R. sondaicus*). van der Maarel 1932: 75 (*R. sivasondaicus* indistinguishable from recent *R. sondaicus*). Sody 1946 (Hooijer's suppression of *R. sivasondaicus* incorrect).

Malaya: Hooijer 1962a (Perak, pleistocene), 1962b (Kelantan).

Sri Lanka: Deraniyagala 1946: 165 (Ratnapura beds, middle pleistocene, description of *Rhinoceros sondaicus simplisinus*).

Sumatra: Hooijer 1945 (M² dext.), 1948 (N. Sumatra, M² sin.).

Thailand: Hatting 1967: 156, 164 (*R. Kwae Noi*, neolithic).

8.8 ECOLOGY AND BEHAVIOUR

8.8.1 Review and field work

Hoogerwerf 1970: 54-57. Schenkel & Schenkel 1969a, summarized in Schenkel 1971. Schenkel & Lang 1969. Schenkel & Schenkel 1969c, d. Sody 1959: 178-209. Tun Yin 1967: 154.

8.8.2 Activity pattern

Bruton 1963: 7. Ridley 1895: 161. Schenkel & Lang 1969: 37-38. Schenkel & Schenkel 1969a: 117-118, 120-121. Sody 1959: 200-201. Thom 1935: 139.

8.8.3 Associations

Bruton 1963: 7. Coomans de Ruiter 1948-49: 153. Couperus 1887. van Doren 1851: 223. Evans 1905: 557. Franck 1935: 41. Higginson 1890: 69. Hoogerwerf 1949, 1970: 95-96. de Monestrol 1925: 21. Müller 1840: 39. Müller & Schlegel 1845: 189. de Poncins 1935: 854. Schenkel & Lang 1969: 36. Schenkel & Schenkel 1969a: 121. Sody 1959: 196-197.

8.8.4 Defecation and urination

Hoogerwerf 1952, 1970: 87-94. Schenkel & Lang 1969: 41 (ritualised). Schenkel & Schenkel 1969a: 114-117 (ritualised; possibly sexual difference).

8.8.5 Dung heaps

Franck 1935: 43. Hoogerwerf 1952 (occasionally large heaps). Schenkel & Lang 1969: 40. Schenkel & Schenkel 1969a: 114 (different individuals, little ritual). Sody 1936: 242 (Sumatra), 1959: 205-208. Thom 1935: 139 (Burma, no heaps). Wood 1930: 61.

8.8.6 Food

Anon. 1935: 90 (browser). van Balen 1914: 213. Bruton 1963: 7. Delsman 1951: 81. van Doren 1851: 223. Epp 1852: 357. Evans 1905: 558 (plants). Franck 1935: 42. van Gorkum 1865, 1868 (kina). Guérin 1980: 179. Guggisberg 1966a: 123. Hoogerwerf 1937: 77, 1950: 57 (eating methods), 1970: 104-114 (methods, list of plants). Kerkhoven 1926: 326. Koningsberger 1902: 60. Müller & Schlegel 1845: 189. de Poncins 1935: 853 (methods). Prater 1965: 231. Schenkel & Lang 1969: 38 (plants, methods). Schenkel & Schenkel 1969a: 107-112 (feeding behaviour, plants). Schenkel et al. 1978. Sody 1959: 201-205. Talbot 1960: 212. Thom 1935: 138-139 (plants). Wood 1930: 61. Zeuner 1934: 32.

8.8.7 Habitat

Anon. 1935: 90 (hills). van Balen 1914: 213. Blanford 1891. Blyth 1875: 51. Bruton 1963: 6. Carter et al. 1946: 152. Couperus 1887. Delsman 1951: 81 (hills). van Doren 1851: 222. Evans 1905: 557 (mountains). Guggisberg 1966a: 123 (mountains). Harrison 1974: 278 (grassy plains). Higginson 1890: 69. Hoogerwerf 1970: 54-57, 87. Jagor 1866: 206 (high altitude). Kerkhoven 1926: 326. Lydekker 1892a, 1907a: 36, 1925: 178 (high altitude). Millet 1930: 188. de Monestrol 1925: 20. Müller 1840: 39. Müller & Schlegel 1845: 185. Prater 1965: 231. Reinwardt 1823: 36 (high mountains). Ridley 1895: 161 (up to 4,000 feet). Schenkel & Lang 1969: 36. Schenkel et al. 1978. Selous n.d.: 183. Smith 1935: 47. Sody 1959: 178-181. van Strien 1978a: 16. Talbot 1960: 206-211. Volz 1912: 372 (mountains). Zeuner 1934: 32.

8.8.8 Longevity

Flower 1931 (in zoos). Hoogerwerf 1970: 73-75, 210. Mitchell 1911a: 453 (maximum in captivity, 130 months).

8.8.9 Movements and paths

Ammann 1980 (daily distance). Bruton 1963: 7. Delsman 1951: 81 (tunnels). Epp 1852: 357 (path). Evans 1905: 557 (wandering). Franck 1935: 46. Hoogerwerf 1937: 76 (path), 1970: 78 (physical capability), 86 (gait), 96 (wandering). Kerkhoven 1926: 326 (path). Millet 1930: 188. Müller 1840: 39 (path). Schenkel & Lang 1969: 38 (locomotion), 40 (path). Schenkel & Schenkel 1969a: 118-120 (path, locomotion), 122-123 (reasons for nomadism). Schenkel et al. 1978: 256. Sody 1959: 120, 181-184.

8.8.10 Population structure

Groves 1971: 245 (sex ratio). Hoogerwerf 1970: 127-129 (structure, sex ratio). Schenkel & Schenkel 1969a: 126-130 (age classes, sex ratio).

8.8.11 Relations with men

van Balen 1914: 213. Bruton 1963: 7. Couperus 1887. Delsman 1951: 81. Evans 1905: 555. Giebel 1855: 206. van Gorkum 1865, 1868. Higginson 1890: 69. Hoogerwerf 1949, 1970: 97-103. Jagor 1866: 207. Kerkhoven 1916. Kloss 1927: 208. Müller & Schlegel 1845: 186. Ridley 1895: 161. Schenkel & Lang 1969: 37. Schenkel & Schenkel 1969a: 123-126. Sody 1959: 184-196. Volz 1912: 372. Wood 1851: 756.

8.8.12 Relations with other animals

General: Evans 1905: 555. Hoogerwerf 1970: 96-97. Sody 1937: 728, 1959: 192, 209.

Other rhino species: Borner 1979a: 78 (ecological displacement).

Tiger: Sody 1959: 192. VerHuell 1836: 125 (tiger eating dung). de Vries 1682: 1200 (tigers accompany rhino to use dung as medicine—cf. Hoogerwerf 1950: 55 and 3.7.5).

Ungulates: Franck 1935: 41-42. Schenkel & Lang 1969: 37.

8.8.13 Salt licks

Schenkel & Schenkel 1969a: 114.

8.8.14 Senses

de Monestrol 1925: 20. Talbot 1960: 211.

8.8.15 *Social behaviour*

Hoogerwerf 1949 (fights).

8.8.16 *Swimming*

Evans 1905: 560. Hoogerwerf 1949. de Poncins 1935: 855. Sody 1959: 121.

8.8.17 *Territory*

Guggisberg 1966a: 123. Schenkel & Schenkel 1969a: 122 (absence of territorial behaviour). Talbot 1960: 211.

8.8.18 *Voice*

Hoogerwerf 1937: 77, 1970: 79-83. Müller & Schlegel 1845: 188. Pollok 1879, I: 96 (at death). Schenkel & Lang 1969: 41. Schenkel & Schenkel 1969a: 121. Sody 1959: 123-124.

8.8.19 *Wallowing and bathing*

Bruton 1963: 7. van Balen 1914: 213. Coomans de Ruiter 1948-49: 153 (mud bath). Franck 1935: 43. Hoogerwerf 1949 (mud bath), 1970: 115-126. Müller & Schlegel 1845: 186. Schenkel & Lang 1969: 40 (wallow). Schenkel & Schenkel 1969a: 112. Sody 1936: 243 (mud bath). Thom 1935: 139 (mud bath).

8.8.20 *Weapons*

Kerkhoven 1926: 326 (teeth). Lydekker 1907a: 36. Smith 1935: 46 (teeth). Sody 1959: 120, 208 (horn, teeth).

8.9 REPRODUCTION

van Balen 1914: 216 (birth season September or August). Hoogerwerf 1970: 129-152 (rut, mating season, gestation, postnatal behaviour). Kerkhoven 1926: 326 (mating season possibly September). Lamare-Picquot 1835: 61 (taste of milk). Lekagul & McNeely 1977: 652, 654 (gestation, oestrous, sexual maturity). Müller & Schlegel 1845: 189 (birth season, birth interval). Schenkel & Schenkel 1969a: 130 (life cycle). Sody 1959: 196-200 (gestation, birth).

8.10 PARASITES

Bequaert 1933: 137-138 (Malaya, horse flies *Tabanus brunneus*, and *Amblyomma crenatum*). Garrod 1877b (Sunderbans, *Plagiotaenia gigantea*). Kraneveld & Keidel 1956 (Java, *Amblyomma crenatum*). Lamare-Picquot 1835: 61 (aptères). Zumpt 1965: 200, 201 (review, e.g. *Amblyomma*, *Anoplocephala*, *Kiluluma*).

8.11 MUSEUM SPECIMENS

Review: Barbour & Allen 1932. Loch 1937: 147.
Adelaide, South Australian museum: Carter & Hill 1942. Finlayson 1950 (one animal). Groves 1971, fig. 9.
Amsterdam, Zoological museum: Hooijer 1946a: 37.
Bogor, Museum: Coolidge 1964: 34.
Bombay, Bombay Natural History Society: Thom 1943: 257. Weatherbe 1939: 150.
Brussels, Institut Royal des Sciences Naturelles de Belgique: Frechkop 1951.
Calcutta, Asiatic Society of Bengal: Asiatic Society 1816. Blyth 1862a: 162, 1862b, c, 1863b: 137.

Calcutta, Indian museum: Blyth 1872b: 3106. W. Sclater 1891: 203.
Calcutta, Zoological Survey of India: Chakraborty 1972: 124. Groves 1967a: 235.
Delft, Ethnologische verzameling: Catalogus 1888 (species uncertain).
Groningen, University: A. Camper 1809: 80, 1811: 19 (from P. Camper).
Halle, Museum: Giebel 1855: 205 (skeleton and mounted skin).
Kuala Lumpur, Fed. Malay States Police Mess: Kloss 1931.
Leiden, Rijksmuseum van Natuurlijke Historie: Hooijer 1946a: 37. Jentink 1887: 167, 1892: 197. Toulou 1902: 16 (2 skulls, formerly attributed to *D. sumatrensis*-cf. Hooijer 1945: 8).
Leiden, G. Vrolik: Dusseau 1865: 160 (2 skulls '*Rhinoceros indicus*, Java'). Vrolik 1830: 389.
London, British Museum (Natural History): Dollman 1932, 1937: 72. Gray 1862: 281-282, 1868: 1009. Groves & Guérin 1980: 203.
London, Royal College of Surgeons of England: Flower & Garson 1884 (nos. 2129-2139).
London, Royal Society: Rookmaaker 1978b: 31 (possible skin acquired in 17th century).
Lyons, Muséum d'Histoire Naturelle: Groves & Guérin 1980: 203. Guérin & Mourer 1969: 50. Morice 1875: 43.
Malaya, Mrs. Barnard: Kloss 1931.
New York, American Museum of Natural History: Carter & Hill 1942.
Paris, Muséum National d'Histoire Naturelle: Groves & Guérin 1980: 203. de Pousargues 1904: 535. Rookmaaker & Visser 1982: 131.
Pelak, Museum: S. Flower 1900: 366.
Selangor, Museum: Kloss 1927, 1931. S. Flower 1900: 366 (unlabelled skull).
Shanghai, Heude Museum: Carter & Hill 1942.
Strasbourg, Musée de L'Institut de Géologie: Gillet et al. 1957: 67.
Utrecht, Zoological Museum: Hooijer 1946a: 37.
Vienna, Naturhistorisches Museum: Antonius 1937. Rookmaaker 1973c: 58.

8.12 EXHIBITION IN CAPTIVITY

8.12.1 *Review*

Grzimek 1960a. Guggisberg 1966a: 117-118. Kourist 1970. Krumbiegel 1960: 13. Reynolds 1961a: 30-33 (list of known specimens), 1968a: 5.

8.12.2 *Keeping within shallow moat*

Epp 1852: 381. Sody 1959: 120. VerHuell 1836: 125.

8.12.3 *Travelling circuses and menageries*

Huguet: Kourist 1973: 149 (Stuttgart 1847-1848). von Martens 1850: 107-110 (from Sumatra, Paris, Brussels, Stuttgart in 1848).
Liverpool rhinoceros: identified as *R. unicornis*; but cf. Blyth 1872a, 1875: 50 (skeleton in Guy's Hospital, Southwark is *R. sondaicus*).
Montgomery Menagerie, U.S.A.: Anon. 1879 (on ship Colon between New York and San Francisco in 1877). Reynolds 1968a (ca. 1877), 1970: 10 (possibly *D. bicornis*).

8.12.4 *Private menageries*

Batavia: van der Chijs 1889: 289 (female, 1661).

- India, Chittepour*: Lamare-Picquot 1835: 61.
Java: Bontius 1642, 1658 (often seen in cages). van Goens 1856: 313 (Royal Palace, Mataram, some rhinos in 1656). Horsfield 1824 (in 1817). Merklein (1672) 1930: 13 (animal lived some days in 1647-repeated by von der Behr 1689: 30 and Saar 1672: 19).
Orissa: Ball 1877: 170 (kept by Rajah in Barpali - as *R. sondaicus*).
Oudh: Sanyal 1892: 131 (King of Oudh, 1877-1887, to Calcutta).
Surakarta: Grzimek 1958: 120 (in 1811).
- 8.12.5 *Zoological gardens*
Adelaide: Cleland 1969: 25 (in 1886). Finlayson 1950 (1885-1907). S. Flower 1931: 202.
Amsterdam: Nieuwendijk 1970: 96 (in 1867, species uncertain).
Bangkok: Cheminaud 1939: 83 (arr. 1938 from Laos). Loch 1937: 134 (ca. 1886).
Calcutta: Dover 1932: 87 (lived over 14 years). S. Flower 1931: 202 (lived over 14 years). Noll 1889 (in 1887-88). Sanyal 1892: 131 (arr. 1887, from King of Oudh). Sclater 1876a (May 1876, lived 24 hours). Wood-Mason 1875: 229 (died 2 December 1875).
London. William Jamrach: Garrod 1877a, b (anatomy). Sclater 1877 (from Sunderbans).
London, Zoological Society: Dover 1932: 87 (longevity 11 years). Flower 1931: 202 (1874-1885). Kourist 1969a (2 pictures ca. 1884). Newman 1874 (arr. 1874). Rookmaaker 1982: 6 (1874-1885). Scherren 1905: 162 (arr. 1874). Sclater 1874 (arr. 7 March 1874 from Java).
Madras: O'Hara 1907 (caught in Dindings, Malaya; to Perak, sold to Singapore and then to Madras).
Marseilles: Eversmann 1861 (arr. 1857). Krumbiegel 1962 (arr. 1857). Sacc 1861 (formerly 11 years in travelling menagerie).
Vienna: Antonius 1937 (animal collected by Scholl, died en route ca. 1788). Rookmaaker 1973c: 58.

8.13 PHOTOGRAPHS

8.13.1 *Taken in the wild*

Angst 1973: 389 (young animal in Ujung Kulon). Appelman 1934 (2 figures of animal shot by Franck in West Java, 1934 - reproduced by Sody 1941, figs. 1, 2). Hazewinkel 1932, pls. 1-4, 1936: i (animal shot in South Sumatra-reproduced by Brentjes 1978, fig. 11; Sody (1941, fig. 14) 1959, fig. 11; Vageler 1927, figs. 1, 2). Hoogerwerf 1949, 1970: pls. 20-26, 30-41 (pictures taken in Ujung Kulon N.P. of animals, tracks and excrements - some reproduced by Bruton 1963: 7; Delsman 1951, fig. 40; Guggisberg 1966a, facing p. 129; Lekagul & McNeely 1977, fig. 227; Reynolds 1968a, fig. 5; Somberg 1968: 4; Sumati 1976b: 6; Tun Yin 1967; and Ullrich & Ullrich 1968: 252). Schenkel 1971: 159, 160, 185 (pictures taken in Ujung Kulon N.P. - reproduced by Lekagul & McNeely 1977, fig. 228; Schenkel & Lang 1969, figs. 10, 11; Schenkel & Schenkel 1969a, figs. 3, 8 and 1969d: 762). Schenkel 1971: 186-187 (colour picture by E. Schumacher - reproduced by Schenkel & Schenkel 1968a, pl. 3). Schilling 1952, pl. facing p. 49 (photo G.L. Tichelman, labelled as Sumatran rhinoceros). Sody 1959, pl. 5 (animal shot in Preanger - reproduced by Brentjes 1978, fig. 10). Volz 1912, fig. 101 (head of female shot in North Sumatra).

Note: Hoogerwerf made, besides his photographs of the rhinos in the Ujung Kulon N.P., also a movie of some 15 minutes duration, which I saw once during a lecture by Hoogerwerf, possibly around 1972. (Location of the film since Hoogerwerf's decease in 1977 is unknown.)

8.13.2 *Taken in captivity*

Kourist 1969a (2 photos by T.J. Dixon taken in London zoo, between 1874 and 1884 - reproduced also by Kourist 1976: 105, 107 and Rookmaaker 1982: 6).

8.13.3 *Photos of museum specimens*

Carter & Hill 1942: 2. Groves 1971, figs. 9-13. Kloss 1927, pl. 5; 1931, pl. 6 (see Sody 1941, fig. 17). Lekagul & McNeely 1977: 655.

THE INDIAN RHINOCEROS, RHINOCEROS UNICORNIS

9.1. REVIEW

Gee 1948-1964 (especially 1953a, b, 1964). Lang 1961b. Laurie 1978b, 1982. Reynolds 1961a. Ullrich 1964.

9.2 TAXONOMY AND NOMENCLATURE

9.2.1 *Remarks*

Blyth 1862a: 154-156 (broad and narrow types in skulls). Chenu & Desmarest 1858: 9 (the "rhinocéros de Camper" is this species). Zeuner 1952: 130 (prehistoric material from Langhnaj, Gujarat possibly referable to a subspecies distinct from surviving forms).

9.2.2 *Subspecies and synonyms of Rhinoceros unicornis*

Rhinoceros asiaticus Blumenbach, 1797: 126.

Type-specimen: not designated. Blumenbach 1797: 126 referred to Blumenbach 1796, pl. 7 fig. B depicting a skull of *R. sondaicus* first in the possession of Petrus Camper (Rookmaaker & Visser 1982) and later sent to Paris where it was figured by Cuvier 1812a: 1st plate, 1836b, pl. 42 fig. 2.

Type-locality: 'Ost-Indien' (Blumenbach 1797).

Taxon considered valid:

Rhinoceros asiaticus Blumenbach 1797. - Fischer 1814.

Rhinoceros unicornis bengalensis Kourist, 1970: 151. Possibly proposed conditionally, referring to specimens intermediary between *R. unicornis* and *R. sondaicus* in N.E. India, as figured by Jardine 1836, pls. 7, 8; the paintings by Longhi of 1751 and the specimen in Berlin zoo from 1874.

Remarks: Blyth 1872a: 403 (drawing in India House, folds between Indian and Javan species). Kourist 1974: 543 (additional evidence).

Taxon considered valid:

Rhinoceros unicornis bengalensis Kourist 1970. - Kourist 1976.

Rhinoceros indicus Cuvier, 1816: 239.

Type-specimen: not designated.

Type-locality: 'Indes orientales, surtout au delà du Gange' (Cuvier 1816).

Taxon considered valid:

Ceratorhinus indicus: Steinmann & Döderlein 1890.

Rhinoceros indicus: Cuvier 1816. - Ali 1927a. Baker 1887. Baldwin 1883. Beavan 1865. Beddard 1902. Blyth 1842, 1862a, 1863b, 1872a, b. Boitard 1842. Bolau 1893, 1900. Brookes 1828. Cap 1854. Cockburn 1883. Cuvier 1829, 1836a.

Desmarest 1822. Duvernoy 1854. Forbes 1881. Gaebler 1883b. Garrod 1873, 1. Geoffroy 1842-43. Gloger 1841. Griffith 1827. Heck 1896. Helfer 1838. Hodgson 1826a, 1844. van der Hoeven 1855. Jardine 1836. Jentink 1887, 1892. Jerdon 1867. Kaup 1833. Krauss 1851. Lesson 1827, 1838. Lukin 1883. Lydekker 1880a, b, 1881, 1883. Mayer 1852a, 1854. Murie 1870. Newman 1874. Owen 1845. Patte 1934. Pearson 1840. Pöppig 1851. Schinz 1824, 1845. Schlegel 1857. von Schreber 1835. Sclater 1864b. Vogt 1884. Weinland 1862.

Rhinoceros jamrachi Jamrach, 1875.

Type-specimen: female rhinoceros imported by Jamrach in 1874 to London, and exhibited in Berlin zoo from 1874 (still living in 1884). Specimen unknown: Barbour & Allen 1932: 147 ("specimen in the Museum of Comparative Zoology may be the lost type with the formal locality 'Java' added").

Type-locality: 'Mooneypoor' (Jamrach 1875), i.e. Manipur, N.E. India.

Authorship: Name generally attributed to Sclater 1876a: 650 note 3 where he mentioned that William Jamrach "in October 1874 printed an account of the supposed new species on a sheet of green paper, and proposed to call it *R. jamrachii*".

Remarks: Barbour & Allen 1932: 147 (is *R. sondaicus*). Groves 1967a: 234 (is *R. sondaicus*). Groves & Guérin 1980: 206 (is *R. unicornis*). Klös 1969a: 72 (is *R. unicornis*). Reynolds 1961a: 23, 1961c (is *R. unicornis*). Rookmaaker 1977a (is *R. unicornis*). Schlawe 1969: 28 (is *R. unicornis*). Sclater 1876a: 645 (is *R. sondaicus*), 1880: 420 (is *R. unicornis*).

Taxon considered valid by Jamrach 1875 only.

Rhinoceros unicornis var. *sinensis* Laufer, 1914: 159, proposed for the Chinese single-horned rhinoceros (Chinese: se).

Remark: Rookmaaker 1980b: 260 (preoccupied by *R. sinensis* Owen, 1870).

Taxon considered valid by Laufer 1914 only.

Rhinoceros stenocephalus Gray, 1868: 1018, figs. 5, 6.

Type-specimen: British Museum (Natural History), no. 722e = 1846.3.23.4, received from the Zoological Society of London. Pocock 1945b, fig. 2A (figured mesopterygoid fossa).

Type-locality: 'Asia' (Gray 1868) as specimen was unlocalised.

Remarks: Busk 1869: 413 (synonym of *R. sondaicus*). Flower 1876: 450 (synonym of *R. unicornis*).

Taxon considered valid by Gray 1868, 1869b only.

Rhinoceros unicornis Linnaeus, 1758: 56, referring to Jonston 1655: 98, Bontius 1658: 50, Bergen 1746, Gessner 1551 and Aldrovandi 1621 (see Rookmaaker 1981: 114).

Type-specimen: not designated.

Type-locality: 'Africa, Asia' (Linnaeus 1758). Ellerman & Morrison-Scott 1951: 339 (probably the sub-Himalayan tarai of Assam). Lydekker 1916: 48 (sub-Himalayan tarai of Assam). Rookmaaker 1980b: 258 (preferred Lydekker's restriction over that of Thomas). Thomas 1911: 156 (Bengal).

Remarks: Pocock 1944a (*R. unicornis* refers to the great Indian one-horned rhinoceros). Rookmaaker 1980b: 258, 1981: 114 (Linnaeus confused different species in his description).

Taxon considered valid:

- Ceratotherium bicornis*: Asdell 1964.
Rhinoceros indicus unicornis: Noll 1876 - Keller 1909. Laufer 1914.
Rhinoceros unicornis Linnaeus 1758. - (*Note*: this combination was generally used after 1900, with few exceptions) - van Berkhey 1784, de Blainville 1846. Blanford 1891. Blumenbach 1788. Bolau 1879. Brandt 1878a-c, 1879. Brehm 1877. Burchell 1817. Cantor 1846. Chenu & Desmarest 1858. Cuvier 1798. Dryander 1796. Duncan 1892. Fischer 1829. Flower 1876, 1891. Flower & Garson 1884. Flower & Lydekker 1891. Friedel 1872a. Frisch 1775. Garrod 1877b. Gervais 1855. Giebel 1851, 1855. Gmelin 1789. Gray 1821, 1843, 1846, 1862, 1869b. Hodgson 1834. Hooper 1910. Horsfield 1851. Houttuyn 1761. Kerr 1792. Kinloch 1885. Lacépède & Daudin 1802. Layard 1861. Lesson 1842. Lenz 1835. Lydekker 1893. Mohnike 1883. Murray 1866. Nicholson & Lydekker 1889. Noll 1873. Oken 1838. Otto 1788. Owen 1852. Pander & d'Alton 1821. Paul 1893. Pollok 1879. Sanyal 1892. Schinz 1824. Schlegel 1872. Sclater 1872c, 1873a, 1887. W. Sclater 1891. Shufeldt 1893. Strack 1819. Swierstra 1888. Trouessart 1898. Ward 1896. Wood 1851. Wunderlich 1892.
Rhinoceros unicornis unicornis: Kourist 1970, 1976.
Rhinoceros (Rhinoceros) unicornis: Zittel 1891. - Friant 1950. Wroughton 1921.

9.2.3 *Lapsus in names*

- Rhinoceros stenorhynchus*, Busk 1869: 413 (for *stenocephalus*).
Rhinoceros unicornu, Boddaert 1785.

9.2.4 *Lists of synonyms*

- Brandt 1878a: 38. Ellerman & Morrison-Scott 1951: 339. Hooijer 1946a: 81-83. Lydekker 1916: 47-48. Murray 1866: 338.

9.3 NAMES IN VERNACULAR

- Blanford 1891 (Bengali, Hindi). Benveniste 1929: 376 (etymology). Blyth 1862b: 198 (Arabic, sanscrit, modern Indian languages). Das & Mukherjee 1974: 83 (Assamese, Hindi). Mukherjee 1963: 45 (Assamese, Bengali, Hindi, Nepali). Prater 1965: 229 (Hindi, Marathi). Sanyal 1892: 130 (Bengali, Hindi). Wilson 1836: 51 (Bengali, Persian, Sanscrit). Yule & Burnell 1903: 363 (Sanskrit, Hindi).

9.4 EXTERNAL MORPHOLOGY

9.4.1 *Appearance*

- Anon. 1835-36. Barth 1747. Blumenbach 1788: 136, 1797: 126. Blyth 1872b: 3105. Boddaert 1785: 162. Boitard 1842: 404. Brandt 1878a: 38. Brehm 1877: 514. Buffon & Daubenton 1764: 180-186, 198-210. Burton 1962: 208. Crandall 1968: 505. Cuvier 1829: 247. Desmarest 1819: 240. Desmarest 1822: 397. Deuve & Deuve 1962: 99. Duncan 1892: 330. Faujas-St. Fond 1809: 193-197. Figuier 1869: 413. Geoffroy & F. Cuvier 1820. Giebel 1855: 206. Gray 1868. Guggisberg 1966a: 131. Harper 1945: 375. Heck 1896: 1018. Huet 1808: 37. Jardine 1836: 164-171. Krumbiegel 1960: 19. Lang 1961b: 386, 403 (different types). Laurie 1978b: 58-60 (terminology of folds), 1982: 308. Lenz 1835: 326. Lydekker 1892a, 1907a: 28, 1925: 117. Maliepaard & de Vos 1961: 90. Marx & Koch 1910: 163. Mayer 1847: 60. Noll 1873: 48. Oken 1838: 1194. Parsons 1743: 529-536. Pocock 1946b: 310. Prater 1965: 229. Reynolds 1971: 12. Sander 1779. Schinz 1824: 287. von Schreber 1835: 299-303. Shaw 1800: 198.

- Shebbear & Roy 1948: 90. Strack 1819, pl. 76. Talbot 1959, 1960: 187. Tun Yin 1967: 151. Williamson 1807: 44. Wood 1851: 755. Zeuner 1934: 30.

9.4.2 *Colour*

- Blanford 1891. Guggisberg 1966a: 132. Marx & Koch 1910. Noll 1873: 49. von Schreber 1835: 303. Wood 1851: 755.

9.4.3 *Footprints*

- Laurie 1978b: 74. Hoogerwerf 1970: 139, 142. Pocock 1912. Schenkel & Schenkel 1969a: 128.

9.4.4 *Hair*

- Cave 1969: 249, 253, 254 (body hair, eye lashes, absence of facial vibrissae). Groves 1967a: 222. Sander 1779.

9.4.5 *Horn*

- Anon. 1870 (shedding). Blyth 1869b (forward inclined horn), 1870b (shedding). Bolau 1900 (abrasion). Gee 1964: 155 (abrasion). Groves 1971: 241-242. Hill 1958 (irregular horn growth midway between horn and forehead). Lang 1961b: 370, fig. 3 (small additional horns, e.g. New York zoo on forehead). Lubach 1868 (second horn). Lydekker 1900: 22. Mohr 1957. Neville 1927: 196-198, fig. 3 (keratinisation of epidermis). Oldfield 1880: 237. Paul 1893 (shedding). Sclater 1871 (shedding and growth). Ullrich 1964. Wunderlich 1892 (shedding with 10-year regularity).

9.4.6 *Horn measurements*

- Anon. 1909. Buffon & Daubenton 1764: 187. Groves 1971: 241. Inglis 1878: 213 (Nepal). Laurie 1978b: 423 (Nepal). Lydekker 1892a, 1893: 378, 1907a: 29, 1907c: 73. Mohr 1957. Nripendra 1908: 454. Pelinck & Upreti 1972: 6 (Nepal). Sander 1779. Sclater 1871. Stott 1978: 4. Ward 1896: 282.

9.4.7 *Size*

- Anon. 1909 (record height), 1935: 89. Baldwin 1883: 144. Bennett 1834. Blanford 1891. Blyth 1872b: 3105. Boitard 1842: 404. Bolau 1900. Brandt 1878a: 38. Brehm 1877: 514. Burton 1962: 208. Chenu & Desmarest 1858: 7. Crandall 1968: 505. Desmarest 1822: 397. Ellison 1925: 33 (Nepal). Figuier 1869: 118. Frädrieh & Frädrieh 1973: 194. Gee 1953b: 767 (male Kaziranga). Geoffroy & F. Cuvier 1820. Guggisberg 1966a: 131. Heck 1896: 1018. Inglis 1878: 213. Jerdon 1867: 233. Kinloch 1885: 63 (male India). Kirby 1920: 229. Krauss 1851, pl. 26. Lang 1961b: 404, 1967a: 606. Laurie 1978b: 66, 422, 1982: 308. Lenz 1835: 326. Lydekker 1892a, 1900: 22, 1907a: 29. Maliepaard & de Vos 1961: 90. Mayer 1847: 60. Mukherjee 1963: 45. Nripendra 1908: 454 (Cooch Behar, largest specimens shot 1886-1901). Noll 1873: 52. Parsons 1743: 536. Pocock 1912. Prater 1965: 229. Reynolds 1971: 2. Roy 1945: 125. Sander 1779. Schinz 1824: 288. von Schreber 1835: 304. Selous n.d.: 184. Shaw 1800: 199. Silberman & Fulton 1979: 7. Stockley 1928: 100. Talbot 1960: 187. Tate 1947: 353. Tin Yin 1967: 151. Ward 1896: 282. Wood 1851: 755.

9.4.8 *Size at birth and growth*

- Ali 1927b (Calcutta 1925). Blaszkiewicz 1980: 76. Buffon & Daubenton 1764: 191. Chowdhury 1966. Frädrieh & Frädrieh 1973: 195. Gee 1953a: 344, 1953b (growth 2 weeks). Giebel 1855: 207. Guggisberg 1966a: 141. Hagenbeck 1966: 86 (6 months).

Hagenbeck 1969 (growth of hand-reared animal). Hodgson 1826a, b, c, 1834 (Kathmandu, 3 days - 19 months - cf. Rookmaaker 1979: 76). Lang et al. 1977 (weight). Mackler & Buechner 1978: 179. R. 1958. von Schreber 1835: 305. Tate 1947: 354. Wackernagel 1962 (growth).

9.4.9 Skin

Neuville 1927.

9.4.10 Age classes

Laurie 1978b: 65-67.

9.4.11 Individual identification

Laurie 1978b: 58-64.

9.4.12 Sexual dimorphism

Anon. 1935: 89 (size). Guérin 1980: 157, 159 (males slightly larger than females). Laurie 1978b: 64 (sex determined by appearance: differences of adults in size, horn shape, folds). Pocock 1946b: 312 (skulls). Roy 1945: 125 (horn length). Shebbear & Roy 1948: 90 (female smaller than male).

9.5 ANATOMY

9.5.1 General dissections

Burne 1905. Cave 1953a (R. Owen's dissection). Cuvier 1804a (Versailles rhino, 1795). Gervais & Gervais 1875a: 466 (drawings prepared at dissection in 1795). Grassé 1955: 1113-1118. Ingles & Sawyer 1979: 148 (R. Owen's drawings). Jouin 1889: 226-264 (drawings prepared at dissection in 1795). Mayer 1854. Owen 1852. R.S. Owen 1894: 347. Thomas 1801 (young animal).

9.5.2 Organs

Bram: Krueg 1878: 327-330. Mayer 1847: 61. Oboussier 1956: 9 (weight).

Epipharynx: Cave 1974a: 134-136, 1976a.

Eye: Johnson 1901: 25, pl. 15. Mayer 1847: 60, 1852a: 43, 1852b. Rudolphi 1804: 176 (drawing by Vicq-d'Azyr).

Foot glands: Beddard 1902 (as taxonomic character). Cave 1958b (anatomy, histology, description by Owen), 1962a. Pocock 1912.

Heart: Cave 1981 (cardiac receptor system).

Hypophysis: Oboussier 1956.

Intestines: Beddard 1902 (small intestine, as taxonomic character). Gervais & Gervais 1875a, b, c (small intestine). Mitchell 1905: 478. Rawitz 1894: 215 (epithelium). Rudolphi 1804: 176 (drawing by Vicq-d'Azyr).

Kidney: Kolmer 1918: 46 (micro- and macroscopic).

Lymph: Cave 1978 (cervical lymphatics). Cave & Aumonier 1962a: 212 (lymph node histology), 1964a (lymph node structure and histology).

Milt: Retterer & Neuville 1916.

Musculature: Cave 1957 (Owen's discovery of *Musculus depressor palpebrae inferioris* and *M. nictitator*). Saban 1970 (superficial muscles of head and neck).

Parathyroid: Cave 1953a, b (discovery by Owen), 1976b: 417-427. Cave & Aumonier 1966: 51-52 (histology).

Penis: Cave 1964b: 570, 572. G. Cuvier 1810, pl. 24 (this species?). Disselhorst 1904:

312. Forbes 1881. Freund 1930: 416-424. Gerhardt 1909: 358. Kakati & Rajkonwar 1972. Mayer 1847: 61. Parsons 1743: 534. Rudolphi 1804: 176 (drawing by Vicq-d'Azyr).

Placenta: Dolinar et al. 1965. Ludwig & Dolinar 1963. Ludwig & Müller 1965. Ludwig & Villiger 1965.

Reproductive organs: Disselhorst 1904: 312.

Salivary glands: Cave 1982.

Stomach: Opper 1896: 333.

Temporo-ptyergoid ligament: Cave 1979b: fig. 5b.

Thymus: Cave 1964a: 75.

Thyroid: Cave 1976b: 417-427, 1976c.

Tongue: Cave 1977, 1980 (musculature). Opper 1900: 245, 327. Parsons 1743: 531.

Tonsils: Cave 1979a: 477-482.

9.6 OSTEOLOGY

9.6.1 Skull

Brandt 1878a: 38. Cave 1959 (foramen ovale), 1965: 501 (lacrymal epiphysis). Chakraborty 1972 (occipital surface, foramen magnum, subaural channel). Gray 1868: 1011. Guérin 1980: 33-54. Pocock 1944b: 836, 842 (premaxillae), 1945a: 343 (nasal septum), 1946b: 310. von Schreber 1835: 305. Spix 1815: 21, pl. 7 fig. 21. Thenius 1955a (ossification nasal septum). Zeuner 1934: 45 (shape in captive specimens).

9.6.2 Skull measurements

Chakraborty 1972. Finlayson 1950: 154. Gray 1868: 1032. Guérin 1980: 48, 53. Laurie 1978b: 423 (Nepal).

9.6.3 Dentition

Beden & Guérin 1973: 23 (size). de Blainville 1846: 51-58. Boitard 1842: 404. Chenu & Desmarest 1858: 6. Cuvier 1812a: 2nd plate, 1836b, pl. 40. Desmarest 1819: 240. Deraniyagala 1946: 167 (size upper molars). Faujas-St. Fond 1809: 193-197. Gray 1968. Guérin 1980: 54-73 (description, measurements). Heck 1896: 1018. Lang 1961b: 404 (length incisors). Laurie 1978b: 102-104 (incremental lines in cementum and dentine of lower incisor as measure of age). Lydekker 1880a, 1892a, 1893: 378. Mayer 1847: 58. Owen 1845: 587ff. Pocock 1946b: 311. von Schreber 1835: 305. Ullrich 1964: 247. Zeuner 1934: 30.

9.6.4 Postcranial skeleton

Banerjee & Chakraborty 1973 (subfossil bones compared with recent female, size). Beden & Guérin 1973: 25-35 (size of some bones). de Blainville 1846: 10-36. Chenu & Desmarest 1858: 4. Clutton-Brock 1965: 10 (scapula size). Cuvier 1804b, 1812a: 3-12, 1st plate, 1822: 5-20, 1836b, pl. 39. Grassé 1955: 1107-1113. Gray 1862: 281 (vertebral formula). Guérin 1980: 74-152 (descriptions and measurements of bones). Heller 1913: 15, 32 (vertebral formula; size). Pander & d'Alton 1821: 18-20. Pouchet & Beaugard 1889: 189-200. Prashad 1936: 31 (scapula). Schinz 1824: 287, pl. 1a.

9.7 PHYSIOLOGY

Burton 1962: 208 (temperature). Hooper 1910: 518 (urine analysis). Jones 1979: 242, 245 (vit. A and copper levels; haemoglobin and serum biochemistry). Kassam & Lasley 1981 (estrogen concentration in urine samples). Mayer 1847: 60 (breathings and heart beats per minute; skin temperature). Ruedi & Müller 1975 (breath frequency). Vogel 1817: 157-162 (urine analysis).

9.8 GENETICS

Höslü & Lang 1970 (chromosomes, diploid number $2n=82$). Wurster & Benirschke 1968 (description of chromosomes, $2n=82$).

9.9 DISTRIBUTION AND STATUS

9.9.1 *General reports*

Anon. 1967d (status 1963, 1967), 1967h (status). Appelman 1959. Coolidge 1964: 34 (status 1961). Crandall 1968: 505 (from Kashmir to Indo-China). Desmarest 1822: 397. Ellerman & Morrison-Scott 1951: 339. Faunthorpe 1924b: 206. Gee 1948b: 64. Haltenorth & Trense 1956: 110. Hutchinson & Ripley 1954: 178. Krumbiegel 1960, fig. 2 (map of former occurrence). Lang 1961b: 372 (status). Laurie 1978b: 370-384 (management and conservation of existing populations). Lydekker 1893: 378. Murray 1866: 338. Oken 1838: 1194. Ripley 1952: 570, 1966: 149 (status). Sanyal 1892: 130. Schenkel & Lang 1969: 1. von Schreber 1835: 306. Spinage 1962: 79 (map). Sterndale 1884: 405. Stonehouse 1981: 58 (map). Stott 1978: 5.

9.9.2 *Bhutan*

Baker 1887: 257 (foot of Bhutan hills). Baldwin 1883: 145. Beavan 1865 (R. Teesta, shot). Brandt 1878a: 39. Hobley 1932: 20. Jerdon 1867: 233. Kinloch 1885: 61, 1904: 59. Maliepaard & de Vos 1961: 93. Sclater 1872c, 1875a (drawing of living specimen), 1876a: 649. Selous n.d.: 186. White 1909: 235, 322 (lower valleys, uncommon).

9.9.3 *India and Bangladesh*

Review: Guggisberg 1966a: 133-137. Harper 1945: 376-380. Laurie 1978b: 12, 394-398. Mukherjee 1963: 45-47, 1974: 340, map. Rookmaaker 1980b: 254-258. Seshadri 1969: 92-95, 105.

Status: Anon. 1963c, 1967b. Ali 1950. Berg 1933: 51, 119. Crandall 1968: 505. Fitter 1968: 59, 1974b: 444. Gee 1950a: 86, 1950b: 1733, 1952a: 224, 1953a: 341, 1958: 353, 1963b: 512, 1964: 157. Grzimek 1958: 118, 1960a: 22. Kirk 1968: 150. Laurie 1978b: 12. Maliepaard & de Vos 1961: 93 (1926-1959). Martin 1981a. Reynolds 1971: 13. Schaurte 1968: 286, 290. Schenkel & Schenkel 1980. Shebbeare 1953: 143. Simon 1966, 1967. Spillett 1966, 1968. Stonehouse 1981: 62. Stracey 1949: 472. Talbot 1960: 191-194. Ullrich & Ullrich 1968: 203. Ullrich 1964: 225. Waller 1972a: 6 (1964-1972).

Hunting: Baker 1887: 252-257. Gee 1948a (pits), 1952c, 1964: 159. Kinloch 1904: 59-65. Nripendra 1908. P. Ryhiner 1952. Street 1961: 101 (pits). Talbot 1959: 563. Ullrich & Ullrich 1968: 57, 77. Ullrich 1964: 217.

'India' only: Blyth 1872b: 3106. Bourret 1927: 62. Brehm 1877: 515. Burton 1962:

208. Desmarest 1819: 243. Dollman 1937: 73. Duncan 1892: 330. Fischer 1829: 413. Fitter 1974a: 343. Gray 1868. Hartert 1901-02: 231. Heck 1896: 1018. Jordanus 1863: 18. Layard 1861: 61. Lydekker 1925: 117. de Rennefort 1702: 482. P. Ryhiner 1952. Schaller & Simon 1970: 14. Schinz 1824. Stockley 1928: 101. Tate 1947: 352.

Records:

General: Ara 1954: 70 (Bihar, last shot in Champaran, 1938). Baker 1887: 249, 251 (R. Langai, Sylhet; Cachar until 1825; Purneah, base of Rajmahal hills, extinct). Baldwin 1883: 145 (Assam, Philibeet dt., Gorruckpore, Tezapore). Bengal Government 1932 (Bengal). Berg 1933: 54, 118 (Bengal, R. Torsa 1932), 1935: 181 (Bengal). Blandford 1891 (Assam, Sikkim, Rajmahal). Blyth 1862d: 366 (Benares). Cockburn 1883 (Bihar, Mirzapore). Dutt-Mazumdar 1954: 158 (Bengal; Cooch Behar). Gee 1949a: 75 (N. Bihar), 1964: 151 (Assam, N. Bihar, N. Bengal). Hobley 1932: 20 (Bengal; Cooch Behar). Horsfield 1851: 195 (Gwalpara, near Assam border, one shot 1777). Inglis et al. 1919: 825 (Jalpaiguri dt.). Jerdon 1867: 233 (limits discussed). Lydekker 1907a: 30, 32 (Rajmahal; Cooch Behar). Mountford 1969: 39 (intention to re-introduce in Sunderbans). Prater 1965: 230. Shebbeare 1935 (Bengal, localities; Cooch Behar), 1948 (Nilpara, increase since 1938), 1953: 141-142 (Rohilkand, Uttar Pradesh, 19th century; Rajmahal hills until 1850). Simson 1886: 188 (Bengal, localities). Williamson 1807: 45, 46 (seldom west bank of Ganges; hunt at Derriapore 1788). Wood 1930: 68 (Bengal, localities). Yule in Jordanus 1863: 18 (Rajmahal hills).

Assam: Anon. 1972a (Jaldapara, 29 poached 1971), 1972f (Jaldapara). Baker 1887: 252-256 (Goalpara). Blyth 1872b: 3108. Brandt 1878a: 39. Burnett 1958: 324 (Manas, status 1948, 1958). Butler 1847: 28. Gee 1949a: 75 (Jaldapara, status 1932, 1940), 1964: 121, 138 (Tirap Frontier Tract; Manas status). Ghosh 1945 (3 killed 1943-44). Kinloch 1885: 61, 1904: 59. Lydekker 1913: 41. Martin 1981a (Jaldapara). Pollok 1879, 1: 95 (localities). Ripley 1952: 572 (north of Brahmaputra near Kaziranga). Roy 1945 (Jaldapara). Sclater 1872c: 426. Selous n.d.: 186. Shebbeare 1953: 144 (Gorumara). Shebbeare & Roy 1948: 89 (Jaldapara, status 1930-1948). Simson 1886: 188 (localities). Ullrich 1965a (Goalpara, Jaldapara). Waller 1972b: 580, 582 (Jaldapara, Manas). Wayne 1968: 338 (Manas). Wilson 1924: 62, 207. Wood 1930: 68 (localities). WWF 1973 (Jaldapara).

Kaziranga N.P., Assam: Ali 1950. Banerjee 1972. Brooks 1967: 20. Cash & Cash 1971. Das 1969 (status 1908, 1966, poaching 1966-68). Das & Mukherjee 1974: 83 (status). Debraine 1967. Eastmure 1949. Fitter 1968: 59. Gass 1971 (status 1938). Gee 1948b, 1949a, 1963b, 1964: 153. Hill 1968. Khajuria 1956 (conservation problems). Klös 1966: 155 (status, wandering into Mikir mountains). Knecht 1971. Krishnan 1972. Lahan & Sonowal 1973: 267 (census 1972). Laurie 1978b: 12, 394. Schaller & Simon 1970: 14. Seshadri 1969: 97-106. Shebbeare 1953: 144. Stonor 1946. Street 1961: 102 (status 1904-1951). Sumati 1976a: 12. Talbot 1956, 1957. Ullrich & Ullrich 1968. Ullrich 1964: 226 (status), 1965b, 1970, 1972. Vaidya 1967: 151-173. Veselovsky & Veselovsky 1968: 77. Waller 1971, 1972a, b.

North-West India and Pakistan: Ali 1927a: 860-861 (Babur, Suleiman, Jahangir). Babur 1922: 378, 451, 489 (Peshawar region, N. Pakistan, 16th century: 'in Parashawar and Hashnagar jungles, so too between the Sind river and the jungles of the Bhira country; also banks of the Saru-river in Hindustan'). Bhaduri et al. 1972: 440 (Babur, Akbar, 16th century). Blyth 1862a: 199, 1872b: 3107 (R. sondaicus). Cockburn 1883. Gee 1949a: 75 (Punjab, 16th century), 1964: 151 (Peshawar; Kashmir in 1398). Guggisberg 1966a: 132. Harper 1945: 376. Laufer 1914: 78 note 3, 132, 133 note 1. Laurie 1978b: 7-12. Laurie & Olivier 1977: 659, 660. Lydekker

1907a: 30, 1925: 117 (Peshawar; Punjab). Marshall 1931, I: 348, II: 387. Petis de la Croix 1723. Rao 1957: 269-270 (Peshawar; Kashmir 1398). Reynolds 1971: 13. Roberts 1977: 159. Seshadri 1969: 90-92. Shebbeare 1953: 142. Sumati 1976a: 13. Talbot 1957: 389, 1959: 563, 1960: 188-191.

9.9.4 Nepal

Review: Caughley 1969: 21-22 (history). Gee 1959a (map facing p. 62). Guggisberg 1966a: 136. Harper 1945: 378-379. Laurie 1978b: 10-11. Mukherjee 1963: 45-46.

Status: Anon. 1963c. Blower 1973: 274. Caughley 1970. Crandall 1968: 505. Fitter 1968: 59, 1974b: 444 (effects of poaching). Fleming 1969. Gee 1950a: 86, 1950b: 1733, 1953a: 341, 1958: 354, 1963a: 73, 1963b: 512, 1964: 157. Grzimek 1958: 118. Hodgson 1834. IUCN 1971. Maliepaard & de Vos 1961: 93. Mishra & Mierow 1976: 19. Pelinck & Upreti 1972. Reynolds 1971: 14. Rohr 1959. Schaurte 1968: 286. Simon 1966, 1967. Spillett 1966. Stracey 1957. Street 1961: 104. Talbot 1960: 191. Ullrich & Ullrich 1968: 200. Ullrich 1964: 226. Waller 1971: 830. Whitney 1971: 27. Willan 1965b. WWF 1971b.

Hunting: D. 1933. Inglis 1878: 214. Oldfield 1880: 235. Scott 1971. Smythies 1942. *'Nepal' only:* Blanford 1891. Blyth 1872b: 3106. Brandt 1878a: 39. Burton 1962: 208. Dollman 1937: 73. Fitter 1974a: 343. Heck 1896: 1018. Hodgson 1844: 288. Kinloch 1904: 59. Lydekker 1907a, supplement, 1913: 41, 1925: 117. Roy 1945: 125. P. Ryhiner 1952. Sclater 1872c: 426. Stockley 1928: 101. Tate 1947: 353. van't Woudt 1965: 15.

Records: Baldwin 1883: 145 (R. Sardah). Bolton 1975: 16, 17 (Nawalpur, Reu valley). Chesmore 1970: 165 (R. Bagmati, Bilauri area). Ellison 1925: 13, 34 (Dhoba 1921; Morang 1901). Inglis 1878: 204 (Khosi dt.). Jerdon 1867: 233 (terai, as far as Rohileund). Kinloch 1885: 61 (Julpagori). Kirk 1968: 150. Lydekker 1909 (terai). Manners-Smith 1909 (localities). Mitchell & Punzo 1976: 56 (Tampispur). Prater 1965: 230.

Rapti Valley, Chitwan N.P.: Anon. 1935: 89, 1971c, g, 1973h, 1974b. Blower 1974 (poaching). Bolton 1975: 16, 1977: 476. Caughley 1969: 22-24 (census 1968). Gee 1959a, b (status). Laurie 1978a, b, 1982: 312. Oldfield 1880: 235, 237. Pelinck & Upreti 1972 (census). Seidensticker 1976. Shebbeare 1953: 143 (status 1947). Smythies 1953: 219. Smythies 1942: 19, 28, 48. de Stoppelaar 1976. Waller 1972a: 5-7. Willan 1965a, b.

9.9.5 South-East Asia

Rookmaaker 1980b: 258-259 (*R. unicornis* probably never occurred east of India). There are records from many countries:

Burma, North: Blyth 1862a: 151 (absent), 1875: 51. Harper 1945: 380 (doubtful). Laurie 1978b: 8 (possible reports mentioned). Lydekker 1905 (Singpho, possibly *R. unicornis*). Pollok 1879, I: 95 (Arakan, Yonzaleen). Reynolds 1971: 13. Rookmaaker 1980b: 259 (absent, review). Stockley 1928: 101 (absent). Stonehouse 1981: 62 (formerly abundant). Talbot 1959: 563. Tun Yin 1956: 692 (wanderers from Assam), 1967: 153 (in 1962).

Burma, Tenasserim: Blyth 1842: 448 (two heads of *R. unicornis* from Tenasserim), 1875: 51. Fitter 1974b: 444 ("handful" present). Rookmaaker 1977c: 55 (review 19th century sources). Talbot 1960: 188.

China: Krumbiegel 1960: 14 (former occurrence). See *R. sondaicus*, 8.7.5.

Indo-China: Deuve & Deuve 1962: 102 (Laos, 2 names for single-horned rhino), 1964: 28 (Laos, uncertain). Duncan 1892: 330. Harper 1945: 380 (Cochin-China,

uncertain). Llopis 1974b: map. Talbot 1957: 390, 1960: 188. See *R. sondaicus*, 8.7.7. *Malaya:* Cantor 1846: 262. Rookmaaker 1977c: 55 (review). *Thailand:* Duncan 1892: 330. Harper 1945: 380 (doubtful). Llopis 1974b: map. Talbot 1957: 389, 1960: 188.

9.9.6 Prehistoric occurrence

9.9.6.1 General reports
Guérin 1980: 169.

9.9.6.2 India and Pakistan

Laurie 1978b: 6. Lydekker 1880a: 31, 1881: 5.

Banda: Blanford 1891. Cockburn 1883 (fossil).

Bihar: Nath 1976 (Chirand, Saran dt., ca. 1700 B.C.).

Gujarat: Bhaduri et al., 1972: 407 (Lothal). Clutton-Brock 1965: 9-10 (Langhnaj). Momin et al. 1973 (8000-1200 B.C.). Nath 1968: 18 (Lothal, 2000-1200 B.C.), 1969: 104, 107 (Langhnaj; Kalibangan). Sankalia & Karve 1949: 31 (Langhnaj). Zeuner 1952: 130 (Langhnaj, possibly a subspecies not identical with surviving forms).

Madhya Pradesh: Sagreiya 1969: 717, 718 (4th century B.C.).

Madras: Blanford 1891. Gee 1949a: 75. Hooijer 1946a: 84. Krishne Gowda 1975: 309. Lydekker 1880a: 32, 1883: 92 (recent alluvial), 1925: 117.

Mohenjo-Daro: Bhaduri et al. 1972: 406-407. Gee 1964: 151. Lang 1961b: 369. Marshall 1931, I: 72, 205, 348, 353, II: 387.

Narbada: Falconer 1868, I: 21 (mentioned *Rhinoceros Namadicus*, from the valley of Nerbudda). Gee 1949a: 75. Hooijer 1946a: 83-84 (*R. namadicus* Lydekker, 1876). Lydekker 1880a: 31 (earlier named *R. namadicus* but it is '*R. indicus*'), 1883: 92 (pleistocene).

Harappa, Punjab: Nath 1968: 18 (2500-1500 B.C.). Prashad 1936: 30 (scapula). Roberts 1977: 159.

Rajasthan: Banerjee & Chakraborty 1973 (Kalibangan, 3500-4000 B.P.). Nath 1969: 104, 107.

Uttar Pradesh: Baker & Durand 1836: 493 (description of '*R. Indicus fossilis*' from Dadapur collection, Siwalik hills near Maginund). Gee 1949a: 75 (fossilized).

9.9.6.3 Java

Dubois 1908: 1259 (description of *R. kendengindicus*). Hooijer 1949: 126 (*Rhinoceros unicornis kendengindicus* Dubois differs from recent form, is not ancestral to it).

9.10 ECOLOGY AND BEHAVIOUR

9.10.1 Review and field-work

Gee 1953a, b. Jones 1979: 240 (zoo animals). Laurie 1978b (comprehensive ecological study, e.g. pp. 67-77: census methods; 292-298: changes of behaviour with age; 299-310: individual differences of behaviour; 328-345: selective consequences of individual behaviour; 345-369: evolution of behaviour), 1982. Ullrich 1964 (popularized in Ullrich & Ullrich 1968).

9.10.2 General reports

Brehm 1877: 520ff. Chenu & Desmarest 1858: 7-8. Gee 1953c (questionnaire).

Haltenorth & Trense 1956: 110. Jacobi 1961.

9.10.3 Activity pattern

Baldwin 1883: 145. Gee 1948a: 106. Lang 1961b: 405. Laurie 1978b: 143, 146-152. Lydekker 1907a: 31. Sander 1779 (sleep). Schenkel & Lang 1969: 34. Shebbeare & Roy 1948: 90. Ullrich 1964: 247, 1965b: 99. Veselovsky & Veselovsky 1968: 80. Wood 1930: 61.

9.10.4 Associations

Beavan 1865: 170. Burton 1962: 208. Gee 1953b: 770, 1964: 158. Giebel 1855: 208. Hutchinson & Ripley 1954: 178. Kakati & Rajkonwar 1972. Laurie 1978b: 215-225 (groups and associations), 263-275 (interactions between individuals), 301-302 (interactions between females), 303-309 (interactions of males with others), 309-311 (interactions between adult males); 1982: 316, 323-328 (interactions). Lydekker 1907a: 30. Mukherjee 1963: 47. Prater 1965: 230. Schenkel & Lang 1969: 32. Schinz 1824. Selous n.d.: 182. Tong 1954. Ullrich 1964: 237. Ulmer 1956. Williamson 1807: 47.

9.10.5 Defecation and urination

Gee 1948a: 107. Lang 1961b: 405. Laurie 1978b: 243-252, 1982: 319. Schinz 1824.

9.10.6 Dung heaps

Anon. 1935. Gee 1948a: 107, 1953b: 771, 1964: 158. Hutchinson & Ripley 1954: 178. Inglis 1878: 214. Kakati & Rajkonwar 1972. Laurie 1978b: 252-254, 318. Mukherjee 1963: 47. Prater 1965: 230. Ripley 1952: 572. Schenkel & Lang 1969: 35. Shebbeare & Roy 1948: 90. Smythies 1942: 28. Sumati 1976b: 5. Talbot 1960: 202. Ullrich 1967: 59. Williamson 1807: 46.

9.10.7 Food

Anon. 1935: 89. Blaszkiewitz 1980: 80, 86, 91, 94 (captivity). Boitard 1842: 404. Bolton 1975: 16. Brahmachary et al. 1970 (Manas). 1974 (Kaziranga). Burton 1962: 208. Gee 1964: 160. Guérin 1980: 179. Jones 1979: 241. Kakati & Rajkonwar 1972. Laurie 1978b: 115-134, 200-207, 399-406 (diet), 134-135 (methods of eating), 135-139 (feeding in cultivated lands), 139, 207 (drinking); 1982: 313-315. Laurie & Olivier 1977: 660 (introduced plants). Lydekker 1907a: 31. Mukherjee 1963: 47. 1974: 340. Nelson 1978: 764. Prater 1965: 230. Roy 1945. Schenkel & Lang 1969: 34-35. Schinz 1824. Selous n.d.: 182. Sigel 1881: 361. Shebbeare & Roy 1948: 90. Ullrich 1964: 232, 1965b: 99. Veselovsky & Veselovsky 1968: 80. Zeuner 1934: 30.

9.10.8 Habitat

Anon. 1935. Beavan 1865: 170. Boitard 1842: 404. Bolton 1975: 16. Burton 1962: 208. Butler 1847: 28 (high grass, swamps). Caughley 1969: 24-26. Guggisberg 1966a: 137. Laurie 1978b: 12, 14, 19-45, 88. Lydekker 1907a: 31. Mukherjee 1963: 47, 1974: 340. Oldfield 1880: 235. Pelinck & Upreti 1972: 6. Prater 1965: 230. P. Ryhiner 1952. Schenkel & Lang 1969: 32. Schinz 1824. Selous n.d.: 182. Seidensticker 1976: 190. Shebbeare 1953: 143. Stracey 1949: 471. Talbot 1960: 194-198.

9.10.9 Home range

Laurie 1978b: 167-200, 1982: 320-321, 323.

9.10.10 Longevity

Blaszkiewitz 1980: 72. Dover 1932: 87. Flower 1931: 202. Gee 1953a: 345, 1953b: 767. Hodgson 1834. Lang 1976: 164. Laurie 1978b: 102-104. Lydekker 1907a: 31. Mitchell 1911a: 453 (maximum 281 months). Mukherjee 1963: 47, 1974: 340. Reynolds 1961a: 18. Schinz 1824 (100 years).

9.10.11 Movements and paths

Baldwin 1883: 145 (long distance travel). Berg 1933: 79 (path). Caughley 1969: 26 (sedentary). Hutchinson & Ripley 1954: 178 (wandering). Inglis 1878: 214 (migration). Klös 1966: 153 (wandering during monsoon in Kaziranga; path). Laurie 1978b: 152-166, 183-200 (movements), 183-189 (individual wandering); 1982: 322. Ripley 1952: 572 (wandering). P. Ryhiner 1952 (path). Schenkel & Lang 1969: 33 (nomadism). Ullrich 1964: 237, 1965b: 99, 1967: 59 (path).

9.10.12 Play

Gerlach 1964: 41. Hediger 1949: 34. Inhelder 1955. Lang 1961b: 373. Laurie 1978b: 267-268. Mackler & Buechner 1978.

9.10.13 Population structure

Lahan & Sonowal 1973: 268 (sex ratio, mortality). Laurie 1978b: 87 (density), 89-94 (sex ratio), 100-102 (mortality), 106-107 (changes); 1982: 132 (density, sex and age composition). Pelinck & Upreti 1972: 5 (age structure). Seidensticker 1976: 195-196 (sex ratio), 199 (biomass).

9.10.14 Relations with man

Baldwin 1883: 145. Boitard 1842: 404. Brightwell 1948: 31. Desmarest 1819: 241. Dubois 1852: 207. Gee 1949a: 73, 1953b: 767-769, 1964: 111, 155, 161. Guggisberg 1966a: 138. Inglis 1878: 214. Laurie 1978b: 53-56, 291. Lydekker 1907a: 31. Marx & Koch 1910: 162. Mukherjee 1974: 340. Reynolds 1971: 14. P. Ryhiner 1952. Schenkel & Lang 1969: 33. Schinz 1824. von Schreber 1835: 307. Selous n.d.: 182. Seshadri 1969: 98. Smythies 1942: 28. Street 1961: 105. Sumati 1976b: 5. Ullrich 1964: 234-237. Veselovsky & Veselovsky 1968: 79. Wood 1930: 64-68.

9.10.15 Relations with other animals

General: Gee 1963b: 512. Seshadri 1969: 59. Talbot 1960: 198-200. Ullrich 1964: 232, 237.

Birds symbiosis: Guggisberg 1966a: 143. Schenkel & Lang 1969: 33. Ullrich 1965b: 99.

Elephant: H. van den Bergh 1973 (contact behaviour in zoo). Berg 1933: 91. Butler 1847: 29. Duncan 1892: 330-332. Gass 1971. Gee 1964: 112. Glover 1956. Inglis 1878: 214. Knighton 1900: 164. Oldfield 1880: 235. Reynolds 1971: 14. Roy 1945. Schenkel & Lang 1969: 33. Schinz 1824. Shebbeare 1955. Street 1961: 105. Ullrich 1964: 244. Williamson 1807: 44.

Tiger: Burnett 1958: 325. Gee 1963b, 1964: 113, 156. Guggisberg 1966a: 140. Knighton 1900: 165. Lahan & Sonowal 1973: 269. Laurie 1978b: 101. Mukherjee 1974: 340. Reynolds 1971: 14. Roy 1945. Schinz 1824. Shebbeare & Roy 1948: 90. Street 1961: 105. Ullrich 1965b: 100.

9.10.16 Salt licks

Laurie 1978b: 140-142, 1982: 315.

9.10.17 *Senses*

Desmarest 1819: 241. Inglis 1878: 214. Laurie 1978b: 314. Schinz 1824. Sumati 1976b: 5. Veselovsky & Veselovsky 1968: 79.

9.10.18 *Social behaviour*

General: Dixon & MacNamara 1981 (zoo).

Communications: Laurie 1978b: 228-242, 313 (vocalisations), 243, 316-319 (olfaction), 254-257 (reactions to scent), 257-263, 316 (physical contact); 1982: 317.

Fights: Gee 1963b: 510. Laurie 1978b: 101. Schenkel & Lang 1969: 35.

9.10.19 *Territory*

Hutchinson & Ripley 1954: 178. Owen-Smith 1971b: 294 (grazing and sleeping territories). Ripley 1952: 572 (territory marked by dung heaps), 1958: 173. Schenkel & Lang 1969: 35. Ullrich 1964: 237, 1970: 105. Veselovsky & Veselovsky 1968: 79.

9.10.20 *Voice*

Boitard 1842: 404. Desmarest 1819: 241. Gee 1953b: 769, 1964: 158. Guggisberg 1966a: 143. Laurie 1978b: 225-228, 1982: 317-318. Sander 1779. Ullrich 1964: 224. Veselovsky & Veselovsky 1968: 79.

9.10.21 *Wallowing and bathing*

Burton 1962: 208. Dubois 1852: 207. Gee 1948a: 106, 1963b: 511, 1964: 155. Laurie 1978b: 143-145. Lydekker 1907a: 31. Roy 1945. Schinz 1824. Talbot 1960: 202. Veselovsky & Veselovsky 1968: 80.

9.10.22 *Weapons*

Baker 1887: 251 (incisors, occasionally horn). Berg 1933: 92 (horn). Boitard 1842: 404. Gee 1963b: 510 (incisors). Glover 1956 (incisors). Guggisberg 1966a: 140. Lydekker 1907a: 30, 1925: 117 (lower incisor). Mohr 1957 (maybe horn). Oldfield 1880: 235 (horn). Roy 1945 (horn). Schenkel & Lang 1969: 34. Schinz 1824. Seshadri 1969: 98. Shebbear 1955 (incisors). Sumati 1976b: 5 (teeth). Ullrich 1965b: 99. Wood 1930: 61 (tusk).

9.11 REPRODUCTION

9.11.1 *General reports*

Bhatia & Desai 1971, 1975 (Delhi zoo). Buechner & Mackler 1976, 1978 (Washington zoo). Buechner et al. 1975 (Washington zoo). Dixon & MacNamara 1981 (Washington zoo). Jones 1979: 242-243. Kakati & Rajkonwar 1972. Krishna Gowda 1969 (Mysore zoo). Lang 1957, 1961b, 1967a: 603-605, 1972 (Basel zoo). Laurie 1978b: 95-100, 275-291 (Nepal). Ripley 1952: 571. Schenkel & Lang 1969: 43-53. Wackernagel 1962 (Basel zoo).

9.11.2 *Age of sexual maturity*

Frädrieh & Frädrieh 1973: 195.

9.11.3 *Birth*

Blaszkiewitz 1980: 77, 88. Hagenbeck 1966 (Hamburg zoo).

9.11.4 *Courtship and copulation*

Asdell 1964: 534. Blaszkiewitz 1980: 74, 83, 88, 92. Fitter 1968: 107. Gee 1953a: 342, 1953b, 1964: 164. Guggisberg 1966a: 140. Inhelder 1955 (sexual foreplay). Lang 1956 (oestrous intervals), 1958 (copulation), 1975: 297. Laurie 1982: 328. Reynolds 1971: 15. Schenkel & Lang 1969: 35. Speiser 1973. Tong 1961 (oestrous, hormone treatment). Ullrich 1964: 244, 1965b: 99, 1967: 57. Williamson 1807: 45.

9.11.5 *Gestation*

Anon. 1935: 89. Ali 1927b. Ali & Santapau 1958a. Blaszkiewitz 1980: 76, 83, 88, 92. Brocklehurst 1931: 110 (8 months). bs. 1970. Burton 1962: 208. Chenu & Desmarest 1858: 8. Chowdhury 1966. Crandall 1968: 513. Figuier 1869: 118 (9 months). Frädrieh & Frädrieh 1973: 195. Gee 1953b: 767, 1964: 160. Giebel 1855: 208. Guggisberg 1966a: 141. Hagenbeck 1969. Hodgson 1826a, 1834. Hutchinson & Ripley 1954: 178. Klös 1972a, b, 1976. Lang 1976: 164, 1977. Lang et al. 1977. Mukherjee 1963: 47. Prater 1965: 230. R. 1958. Reed 1974a, b. Schinz 1824. Shebbear & Roy 1948: 90 (18 months). Street 1961: 107. Tate 1947: 354 (19 months). Tong 1961.

9.11.6 *Hand-rearing*

Blaszkiewitz 1980: 89 (Hamburg). Hagenbeck 1966 (Hamburg). Hagenbeck 1969 (Hamburg).

9.11.7 *Mating season*

Anon. 1935: 89. Asdell 1964: 534. Berg 1933: 116 (late March). Blaszkiewitz 1980: 76. Fraser 1968: 107. Gee 1952a: 226, 1953a: 342, 1953b: 766. Hutchinson & Ripley 1954: 178. Lang et al. 1977. Mukherjee 1963: 47 (not fixed), 1974: 340. Prater 1965: 230. Ullrich 1964: 244, 1967: 57 (April-May).

9.11.8 *Milk composition*

Klös et al. 1972, 1974. Lang 1961b: 392, 1967b. Nelson 1978: 765.

9.11.9 *Mother's behaviour to child*

Hagenbeck 1966: 82. Gee 1963b: 512. Guggisberg 1966a: 142. Lang 1961b: 393. Laurie 1982: 329. Mackler & Buechner 1978. Schenkel & Lang 1969: 35. Ullrich 1967: 65.

9.11.10 *Twins*

Gee 1955.

9.12 PARASITES

Cobbold 1879: 401-402 (Gastrophilus rhinocerotis, rhino bot). Hoare 1937 (Triplumaria hamertoni, a cycloposthiid ciliate). Lang 1966: 302 (in dung, Basel zoo). Laurie 1978b: 425 (Nepal). Murie 1870 (Taenia magna from intestines). Watson 1945 (Triplumaria hamertoni, Entodinium sp., cycloposthiid ciliates from alimentary canal). Zumpt 1965: 201, 205 (Amblyomma, Anoplocephala; Protozoa).

9.13 VETERINARY STUDIES

Anon. 1896: 280 (Breslau zoo, cause of death), 1918 (carditis), 1943 (renal failure). Bhattacharjee & Halder 1971 (death due to fascioliasis; *Fasciola gigantica* in liver). Blaszkiewitz 1980: 73-74, 96. Bolau 1900 (nose inflammation and kidney complaints). Buechner et al. 1975: 160 (Washington zoo, cause of death). Ensley & Bush 1976 (rectal prolapse). Gee 1948a: 107 (septicaemia). Hamerton 1939: 290 (osteo-arthritis), 1943: 127 (tuberculous pulmonary cirrhosis). Harthoorn 1976: 202 (immobilisation of captive animal). Jones 1979: 224-245 (restraint in zoos), 246-250 (review). Lang 1966 (Basel zoo), 1975: 297-298 (review), 1976 (review). Marx & Koch 1910: 164 (tumor in uterus). Nandi & Deb 1972 (horn cancer). Nelson 1978: 766 (zoo animals). Norwood 1929: 91 (asthma). Ruedi & Müller 1975 (chronic pneumonia). Scott 1927 (postmortem and histological examination; sarcoma of heart and lungs). Ullrich 1964: 247 (wounds on side).

9.14 MUSEUM SPECIMENS

Bombay, Bombay Natural History Society: Bombay nat. hist. soc. 1901 (head donated by H. Tickborne), 1909 (specimen donated by A. Butcher), 1914 (horn donated by F. W. Gore).

Calcutta, Asiatic Society of Bengal: Blyth 1842 (2 heads from Tenasserim), 1851 (skeleton, C. Huffnagle). Jerdon 1867: 233 (skulls, Fortescue). Pearson 1840: 518 (skull, Wallich; skeleton, J.H. Barlow).

Calcutta, Indian Museum: W. Sclater 1891: 202.

Calcutta, Zoological Survey of India: Chakraborty 1972: 124.

Calcutta, Medical College: Blyth 1862a: 163.

Cape Town, South African Museum: Layard 1861: 61 (one skull).

Dublin, Trinity College: Blyth 1875: 53 (skull, shot by Oldham).

Exeter, Royal Albert Memorial Museum: Howes & Bamber 1970: 327 (2 specimens).

Frankfurt am Main, Senckenberg: Marx & Koch 1910 (female from Frankfurt zoo).

Hamburg, Zoologisches Museum: Bolau 1900 (male animal).

Ipswich, Museum: Lydekker 1907a: 29 (mounted specimen). *Note*: The specimen is still on show, came from British Museum (Natural History).

Königsberg (Kaliningrad), Museum: Fitzinger 1860: 52 (died in menagerie, 1839).

Leiden, Rijksmuseum van Natuurlijke Historie: Hooijer 1946a: 83. Jentink 1887: 167, 1892: 197.

Leiden, W. Vrolik: Dusseau 1865: 160 (young skull, List).

Liverpool, Free Museum: Gray 1868: 1011.

London, British Museum (Natural History): Gray 1843: 186, 1846: 35 (Hodgson's specimens), 1862: 281, 1868: 1011. Home 1823, pl. 60 fig. 2 (horn). Lydekker 1913: 41. Pocock 1946c.

London, East India Co. Museum: Horsfield 1851: 195 (horn).

London, Guy's Hospital: Blyth 1872a: 404, 1872b: 3106, 1875: 50. Gray 1868: 1011.

London, W. Jamrach: Buckland 1882: 217 (skulls from India, 1867).

London, Royal College of Surgeons of England: Flower & Garson 1884 (nos. 2121-2128). Gray 1868: 1011. Pocock 1946c.

Manchester, Museum: S. Flower 1906: 26 (mounted specimen from zoo).

Moscow, Museum: Blyth 1870b (detached horn, from Moscow zoo).

Mysore, Intermediate College: Deraniyagala 1946: 167 (one skull).

New York, American Museum of Natural History: Anon. 1918 (animal from zoo).

Philadelphia, Academy of Natural Sciences: Ulmer 1959: 6 (male from Philadelphia zoo, 1901).

Stuttgart, Museum: Zeuner 1934: 45 (skull, from menagerie Calcutta).

Vienna, Naturhistorisches Museum: Fitzinger 1860: 52 (from menagerie, 1843).

Yale, Peabody museum: Norwood 1929: 101 (from circus, 1926).

9.15 EXHIBITION IN CAPTIVITY

9.15.1 *Review*

Appelman 1959 (births 1889-1958). Blaszkiewitz 1980: 72-73. Kourist 1969a (brief review), 1970 (19th century). Lang 1961b (1872-1959), 1975 (studbook and list of births since 1941), 1977 (statistics). Lang et al. 1977 (36 births 1956-1975). Reynolds 1961a: 18-30 (all specimens until 1959). Ruedi & Tobler 1980 (studbook, 93 specimens since 1940).

9.15.2 *General reports*

Flower 1931: 202 (longest living animals). Guggisberg 1966a: 130. Hediger 1949: 28. Keyser 1976: 146 (Amsterdam fairs 1814, 1841, 1846). Krishne Gowda 1975: 309-311 (plan for breeding population in S. India). P. Ryhiner 1952. Census of rare animals, International Zoo Yearbook 6: 445, 7: 371, 8: 366, 9: 291, 10: 323, 11: 334, 12: 392, 13: 372, 14: 422, 15: 422, 16: 438, 17: 363, 18: 434, 19: 415, 20: 476, 21: 361. Species of wild animals bred in captivity, International Zoo Yearbook 2: 262, 4: 232, 5: 341, 6: 398, 7: 315, 9: 233, 10: 268, 11: 279, 13: 336, 14: 385, 16: 399, 17: 322, 18: 392, 19: 370, 20: 438, 21: 325.

9.15.3 *American circuses*

Anon. 1873 (Warren & Co., Monroe county, species unidentified). Amidon 1974: 21 (Zoological Institute, 1835). Chindahl 1954: 5 (Raymond & Waring's Extensive Menagerie, 1850), 1959: 64, pl. 23 (Rice, Detroit 1853; Ringling 1920's). Dembeck 1965: 286 (menagerie, 1830). Durant & Durant 1957: 27, 31, 62, 74 (some specimens 1830-1930). Flint 1970: 6 (New England Zoological Exhibition, 1835). Kunzog 1962: 115. 190 (Rice, 1855-1861). Mars 1955: 9 (Raymond & Waring show, 1852). Meyer-Holzappel 1970: 210 (Rice, 1855-1861). Norwood 1929: 90, 96-101 (Ringling, died 1926). Polacsek 1973 (1830-1835). Reynolds 1967a (review 1855-1926, especially Rice 1855-1861, Ringling 1907-1926), 1968a (12 specimens, 1826-1861), 1970 (1860-1900), 1971: 14 (Rice, 1850's). 1982 (Ringling Bros. and Barnum & Bailey circus, 1919-1926). Thayer 1975 (before 1835). Vail 1956: 21 (1826-1835).

9.15.4 *European travelling menageries*

Anon. 1823 (one died 1822). Blyth 1872a: 404, 1872b: 3106, 1875: 50 (Liverpool rhino, is *R. sondaicus*). Buckland 1882: 217 (Edmonds, England). Clarke 1976: 18 (1810-1825, in ceramics). Cuvier 1822: 22 (Paris). Fitzinger 1836 (Tourniaire 1815-1836), 1860: 51-52 (London and Stettin 1840-1843; London and W. Europe 1815-1839). Giese 1962: 126, 137 (Tourniaire in Vienna, 1818, 1838). Goldsmith 1840: 531 note (Liverpool rhino, 1835-36). Heikamp 1980: 319 (Europe 1810-1835). Home 1822: 43-44 (Exeter Change). Hufnagel 1873: 197 (Frankfurt/Oder 1816). Jardine 1836: 171 (Exeter Change 1810, Liverpool 1836). Keizer 1976: 146 (Tourniaire in Amsterdam, 1824). Kourist 1970: 142, 145 (Liverpool 1836, W. Europe), 1974: 544 (Tourniaire). Lehmann 1952: 66 (Tourniaire in Leipzig 1816). Mayer 1847: 60 (male from Liverpool). Oken 1838: 1194 (Germany 1816). Rookmaaker 1973c: 57

(Exeter Change 1770, 1790, 1799; W. Europe 1810-1836). Schinz 1824: 289, pl. 7. (Germany 1815). Sclater 1876a: 650 (Liverpool rhino, *R. sondaicus*, skin to British Museum). Vogel 1817 (Munich 1817).

9.15.5 Private menageries

Butler 1847: 29 (Assam, often tamed, "may be seen at Gowahatty grazing on the plains as harmless cows"). D. 1933 (one caught in Nepal). Darwin 1875: 132 (India, much breeding). Geoffroy 1842-43: 60 (India, Jacquemont saw one in menagerie of Governor General of India at Calcutta). Jacquemont 1841: 169 (Barrackpore Menagerie, Calcutta). Marshall 1931, 1: 348 (Mohenjo Daro, possibly captive). Palmer 1976, fig. 77 (*R. unicornis* draws wagon, "Sam Hague's original slave troupe at St. James's Hall, Lime Street, Liverpool", 1890's). Tavernier (1676) 1977, 1: 93 (Jahanabad, tame in fields). Varthema 1928: 22 (Mecca, 2 unicorns "presented by a King of Ethiopia, that is, by a Moorish king (of Zeila)"). Williamson 1807: 45 (India, specimens briefly in possession of Mr. Cleaveland of Bhanguipore, Mr. Matthew Day of Dacca, and Mr. Young of Patna).

9.15.6 Zoological gardens

Amsterdam: Anon. 1872: 319; 1973b (arr. July 1973 from Berlin). Friedel 1872a: 328 (one present 1871). Kourist 1970: 147 (1864/1867-1873). Noll 1873: 51 (1863-living). Redeker 1982 (arr. 12.12.1978). Swierstra 1888: 19 (arr. 1864).

Antwerp: Anon. 1872: 319. Blyth 1869a. Brehm 1877: 515, 533, pl. facing p. 514 (in 1875). Douliez 1979 (arr. 1971, 1972, to Planckendael). Flower 1908: 12 (arr. 1907), 1931: 203 (died 1898). Friedel 1873: 214 (present 1871). Gens 1861: 93. Gijzen 1960: 16 (1861-1898, ca. 1907). Kourist 1970: 147 (in 1865). Maes 1910. Marx & Koch 1910: 161. Noll 1873: 51. Peel 1903: 61.

Basel: Ali & Santapau 1958a (in 1956). Blaszkiewitz 1980: 73-82. bs. 1970 (in 1969). Gee 1952a, 1953a: 341 (arr. 1952). Grzimek 1960a: 22 (1956, 1958). Guggisberg 1966a: 39. Hediger 1949: 29ff. (arr. 1952). Lang 1956, 1957, 1958, 1961b, 1964, 1967a. R. 1958. Ulmer 1956, 1958.

Berlin East: Blaszkiewitz 1980: 95. Petzold 1969: 619 (arr. 1966).

Berlin West: Blaszkiewitz 1980: 82-87. Flower 1908: 12, 1931: 203. Gaebler 1883b: 243, 1901: 200. Heck 1940 (pair in 1875). Heikamp 1980: 319, 323 (1871-1872, arr. 1872, arr. 1874). Klös 1960 (in 1874, *R. sondaicus*), 1964a (arr. 1959), 1969a: 72 (arr. 1874), 1971 (female to Basel zoo), 1972a, b (1959-1965, pair arr. 1965, births 1972, 1976), 1976 (birth). Kourist 1970: 144 (in 1874). Martin 1878: 35. Marx & Koch 1910: 161 (left 1896 to Frankfurt a. Main), 164 (1872-1909). Noll 1873: 51 (pair arr. 1872), 1876: 336. Peel 1903: 125. Reynolds 1961c (1874-1884, *R. unicornis*). Rookmaaker 1977a (1874-1884, *R. unicornis*). Schlawe 1969: 28 (review). Sclater 1880 (3 specimens). Zukowsky 1965: 1 (died 1907).

Bombay: Hill 1958.

Breslau: Anon. 1896 (died 1895). Gleiss 1967 (1894-1895).

Cairo: Gee 1950b: 1733 (capture), 1953a: 341 (pair arr. 1949).

Calcutta: Ali 1927b (birth 1925). Blyth 1862a: 145 (pair in Barrackpore). Flower 1914: 57 (pair in 1913). Gee 1953a: 341 (pair since 1933, birth 1925). Grzimek 1960a: 22 (birth 1925). Laurie 1978b: 5 (birth 1925). Nandi & Deb 1972 (died August 1970, 47 years old). Noll 1889 (arr. 1887). Ripley 1952: 571. Sanyal 1892: 131 (1878-1880). Street 1961: 107 (birth 1925). Tun Yin 1967: 153 (died 1942).

Chicago: Gee 1948b, 1949a, 1950b (capture), 1953a: 341 (arr. 1948). Street 1961: 107 (arr. 1948).

Cologne: Kohle 1981: 104 (1872-1900). Kourist 1970: 149 (1871-1872). Kullmann 1979: 78 (arr. 1978). Martin 1878: 46. Paul 1893: 331. Wunderlich 1892: 373 (arr. 1872).

Delhi: Bhatia & Desai 1971 (birth 1971), 1975 (arr. 1965, 1968, birth 1971).

Dresden: Knauer 1914: 23, 195 (1873-1872, picture). Martin 1878: 50.

Dublin: Anon. 1835-36: 68 (arr. 1835).

Frankfurt am Main: Epstein 1897: 177 (arr. 1896). Gaebler 1901: 200. Marx & Koch 1910: 164 (1896-1909). Peel 1903: 156. Schlawe 1969: 28 (1896-1909). Seitz 1896: 147 (arr. 1896).

Gauhati: Bhattacharjee & Halder 1971 (died ca. 1970). Chowdhury 1966 (1962-63, 2 births 1963).

Gelsenkirchen: Blaszkiewitz 1980: 95.

Hamburg: Anon 1872: 319. Bolau 1879: 110 (arr. 1869), 1893: 282 (arr. 1870), 1900 (1870-1900). Flower 1931: 202 (1871-1900). Kourist 1969b: 8 (arr. 1870), 1970: 147 (arr. 1870). Martin 1878: 67. Noll 1873: 51 (arr. 1870). Schlawe 1972: 181 (1870-1900). Sigel 1881: 361.

Hamburg (Hagenbeck): Blaszkiewitz 1980: 87-91. Grzimek 1958: 120 (1930-1956). Hagenbeck 1907 (4 present). Hagenbeck 1966 (arr. 1957, birth 1964). Hagenbeck 1969 (birth 1967). Lang 1964 (birth 1964). Lydekker 1909 (3 caught in Nepal). Noll 1873: 53 (2 arr. from Jamrach). Rohr 1959: 959 (arr. 1930).

Kathmandu: Gee 1953a: 344 (birth 1826). Gray 1846: 35 (drawing). Hodgson 1825, 1826a, b, c, d, 1834 (birth 1824). Laurie 1978b: 5 (birth 1826). Rookmaaker 1979 (birth 1824). Ullrich 1967: 61, fig. 8 (2 present).

London (W. Jamrach): Buckland 1882: 217-218 (2 died en route). Noll 1873: 53. Sclater 1875a.

London (Rice): Sclater 1876a: 649.

London (Zoological Society): Anon. 1870 (3 present), 1872: 319 (1 present). Bartlett 1898: 69 (died 1873). Bennett 1834 (arr. 1834). Blyth 1869b. Brightwell 1948: 31. Buckland 1870. Dorsman 1906: 74. Fitzinger 1860: 52 (1834-1849). Flower 1908: 12, 1931: 202. Garrod 1874: 2 (died 1873). Gee 1948a (capture), 1949a: 76 (arr. 1948). Hamerton 1939: 290 (1933-1938), 1943: 127 (died 1941). Kourist 1970: 146 (1856-1894). Loisel 1907: 16. Lydekker 1907a, supplement (1864-1904). Marx & Koch 1910: 161. Mitchell 1912 (arr. 1912), 1925 (arr. 1924), 1933a (arr. April 1933), 1933b (arr. July 1933). Newman 1870, 1872b. Noll 1873: 50 (review). Owen 1894: 347 (died 1848). Pocock 1912 (1886-1911). Sclater 1864b (2 arr. 1864), 1872c: 426,, 1876a (review), 1887 (arr. 1886). Scherren 1905: 59, 241 (arr. 1834, 1864-1904). Weinland 1862: 128.

Lucknow: Heber 1843: 213 (5 or 6 seen). Knighton 1900: 161 (menagerie of King Nussir-u-Deen exhibited 15-20 rhinos in course of time).

Manchester: S. Flower 1906: 26 (1876-died), 1908: 12 (arr. 1907), 1931: 203 (1876-1904). Loisel 1907: 30 (unidentified).

Miami: Anon 1970 (2 arr. 1970). Scott 1971 (pair from Nepal).

Milano: Gee 1952c.

Moscow: Blyth 1868a, 1868b (horn lost, unidentified), 1870b (horn lost).

Mysore: Anon. 1968a (birth 1968). Krishne Gowda 1969 (arr. 1956 and 1965, birth 1968), 1975: 310 (births 1968, 1971).

New York: Reynolds 1962b (died 1962).

Paris: Cap 1854: 157 (one present). Chenu & Desmarest 1858: 3, 4 (1814, 1819, 1850-1854). Desmarest 1819: 240 (in 1815). Figuier 1869: 118. Geoffroy & F. Cuvier 1820 (in 1815). Gervais & Gervais 1875a: 468 (1865-1874). Huet 1808, pl.

31. Jouin 1889: 212 (drawn 1815). Oustalet 1900: 378 (early 19th century, lived over 25 years). Peel 1903: 2 (1795 from Versailles). Schinz 1824: 280 (in 1800). *Philadelphia*: Anon. 1943 (1923-1943). Buck & Anthony 1958: 48-90 (arr. 1923, capture Nepal). Flower 1931: 202 (1875-1901). Snyder & Moore 1968: 178. Ulmer 1941 (1875-1901, arr. 1923), 1956, 1958, 1959.
- Portland*: Reynolds 1964b (arr. 1964).
- Rangoon*: Reynolds 1962a (arr. 1962). Tun Yin 1967: 153 (died 1942).
- San Diego*: Anon. 1978a (birth 1978). Dolan & Moran 1969:61 (arr. 1963). Hill 1964 (arr. 1963). Metzler 1981 (births 1978, 1980). Pournelle 1963b: 14 (arr. 1963 Basel-born), 1965 (arr. 1964 Gauhati-born). Reynolds 1964a (arr. 1963). Stott 1978: 5-8 (birth 1978, preceded by 2 unsurvived).
- St. Louis*: Reynolds 1962b (1934-1962).
- St. Petersburg*: Lukin 1883:280 (1 present September 1882).
- Stuttgart*: Anon. 1970j (birth expected August 1971). Blaszkiewicz 1980: 92-94. Krauss 1851, pl. 26 fig. 2 (in 1847).
- Tokyo*: Aritake 1959 (arr. 1959). Hara 1961 (arr. 1958). Hayashi 1959 (arr. 1959), 1963 (arr. 1958). Sotani 1974.
- Trivandrum*: Flower 1931: 202.
- Versailles*: see 3.15
- Vienna*: Antonius 1937 (1856-1894 to Breslau). Brachetka 1965: 62 (1856-1894). Grzimek 1958: 120. Knauer 1914: 61 (arr. 1856). Kourist 1970: 146. Noll 1873: 53 (arr. 1856).
- Washington*: Anon. 1974c (birth). Buechner & Mackler 1976, 1978 (birth 1974). Buechner et al. 1975 (arr. 1960 and 1963, birth 1974). Dixon & MacNamara 1981. Mackler & Buechner 1978 (birth 1974). Reed 1974a, b (birth 1974). Reynolds 1964a (arr. 1963).
- Whipsnade*: Gee 1948a (arr. 1947, capture Assam), 1950b (capture), 1952c (sent from India, 1952), 1953a (arr. 1952). Grzimek 1960a: 22 (birth 1957). Guggisberg 1966a: 141 (birth 1957). Pocock 1946b: 310 (1933-1945). R. 1958 (birth 1957). Street 1961: 106 (arr. 1947, 1952). Tong 1952a, b (arr. 1952), 1961 (arr. 1947 and 1952, birth 1957). Vevers 1947: 86.

ANALYSIS OF THE LITERATURE