

TAXONOMY & CONSERVATION STATUS



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Despite a glorious past, rhinoceroses have a gruesome present and a grim future. *Rhinocerotidae* is a family of mammals in crisis, with four of the five surviving species (the *Asian Rhinoceros*, *Sumatran* and *Javan*) on the verge of extinction. The fifth species (the *African White Rhino*) has two distinct subspecies. One (the *southern white rhino*) has recovered to population levels less precarious than those of the other rhino species, but even this subspecies suffers from limited distribution and increasing threats from poachers. The other subspecies (the *northern white rhino*) is the rarest of all rhinos. It is possible, and even probable, that rhinos will be extinct in the wild by the end of this century or very early in the next unless there is drastic reversal of their fortunes. The following chapter outlines the taxonomy of rhinoceroses, their life history characteristics and their current conservation statuses.

A BRIEF HISTORY AND OVERVIEW OF RHINOS

The family *Rhinocerotidae* has had a glorious history. Since the first rhinoceros appeared about 50 million years ago, the rhino family has enjoyed abundance and diversity, with many different species that assumed a wide variety of forms and occupied a broad range of niches often associated with other kinds of animals today. Some extinct rhinos had horns; others did not. Some rhinos appeared and acted like horses, others like hippos, some like tapirs, at least one like a small elephant, and several even like giraffes. Indeed, the largest land mammal that ever lived was a rhino.

Moreover, rhinos have not always been confined to Africa and Asia. During most of the last 50 million years, they also inhabited Europe and particularly North America. Rhinos were the commonest of the large herbivores in North America for 40 million years and became extinct only because of drastic climatic changes about 5 million years ago. Today, five rhino species survive: three species in Asia and two in Africa.

In numerous respects, rhinos are typical ungulates. Ecologically, they function as primary consumers, or herbivores, and like most ungulates their weapons are primarily defensive rather than offensive. Rhinos generally inhabit savannahs, shrubby regions and forests in tropical and subtropical regions. Moreover, they are usually restricted to areas in which a frequent trip to water or mud holes is possible. Mud wallowing is especially effective in accelerating heat loss, as mud takes more than an hour to dry and absorbs body heat in the process. A thick coating of mud also helps protect against insects and parasites and keep skin supple.

Generally speaking, rhinos require large individual areas because of their size and daily nutritional requirements. Most are fairly territorial, defending their home ranges to ensure adequate food and minimal reproductive competition. Territories are most often marked

with urine or dung, as rhino vision is poor but olfactory abilities are well-developed. Flakes of skin left on trees used as rubbing posts, as well as dried mud that falls from the skin, also carry individual scents and thus help establish territorial boundaries. Wide variation does exist, however, among the rhino species with regard to the size of individual ranges, the degree of territoriality, and social organization. General species descriptions are provided in Owen-Smith, 1975; Kingdon, 1979; Estes, 1991; Laurie, 1982; and Nowak, 1991. The species descriptions below are summaries; specific ecological studies may cite data that slightly differ from these general descriptions. Word-origin information was obtained from Borror (1960).

GREATER ONE-HORNED RHINOCEROS



SCIENTIFIC NAME AND ORIGIN

- *Rhinoceros unicornis*
- *Rhinoceros*: from the Greek *rhino*, meaning "nose" and *ceros*, meaning "horn"
- *unicornis*: from the Latin *uni*, meaning "one" and *cornus*, meaning "horn"

COMMON NAMES

- Asian greater one-horned rhinoceros: referring to the single large horn
- Indian/Nepalese rhinoceros: referring to the species' endemic range

DISTRIBUTION AND HABITAT

- Northern India, southern Nepal
- Floodplains, riverine grasslands

SIZE

- 1,800 to 2,200 kg (4,000 to 5,000 lb)
- 1.75 to 2.0 m (5.75 to 6.5 ft) tall at shoulder
- Single horn 20 to 61 cm (8 to 24 in.) long
- Largest land mammal (after elephants) along with the African white rhino

PHYSICAL DESCRIPTION

- Brownish-gray, hairless, with rivet-plated (armor-plated), knobby skin
- One horn
- Upper lip semi-prehensile

LIFE HISTORY CHARACTERISTICS

- Grazer (primarily; will consume some browse)
- Mostly solitary; groups of females and young or temporary groups of subadults
- Females sexually mature at 5 to 7 years of age; males at 10 years
- Gestation period approximately 15 to 16 months; interbirth interval of 3 years



Greater one-horned rhino (*Rhinoceros unicornis*) (Photo: T. Foose, Ph.D., *The Wilds*)

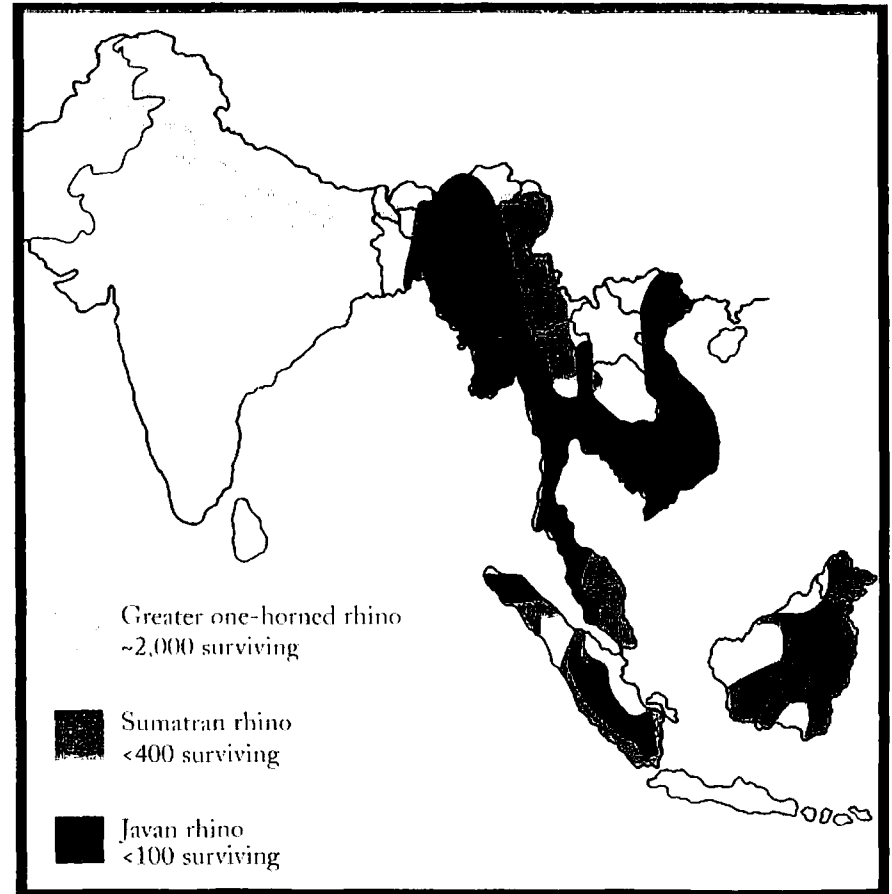


Figure 1. Asian rhino species' historical distributions and current country totals (Map: N. van Steven)

JAVAN RHINOCEROS



SCIENTIFIC NAME AND ORIGIN

- *Rhinoceros sondaicus*
- *Rhinoceros*: from the Greek *rhino*, meaning “nose” and *ceros*, meaning “horn”
- *sondaicus*: probably referring to the Sunda islands in Indonesia. (Latin *-icus* indicates a locality.) “Sunda” means “Java.”

COMMON NAMES

- Javan rhinoceros
- Asian lesser one-horned rhinoceros: in contrast to the greater one-horned rhino because of the single, comparatively smaller horn

DISTRIBUTION AND HABITAT

- Indonesia and Vietnam
- Lowland tropical rainforests

SIZE

- 900 to 1,400 kg (2,000 to 3,000 lb)
- 1.5 to 1.7 m (5 to 5.5 ft) tall at shoulder
- Single horn 25 cm (10 in.) long

PHYSICAL DESCRIPTION

- Gray, hairless; lesser, but still apparent, armor plating
- One horn

LIFE HISTORY CHARACTERISTICS

- Mostly a browser but some grazing
- Generally solitary except for mothers and young or mating pairs
- Females sexually mature at 3 to 4 years of age; males at 6 years
- Gestation period approximately 16 months; interbirth interval of 4 to 5 years

SUMATRAN RHINOCEROS

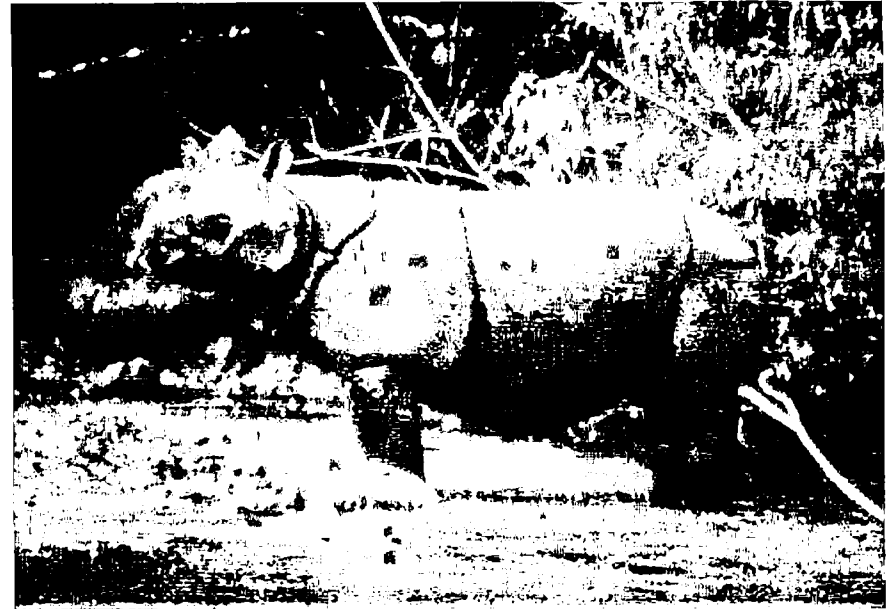


SCIENTIFIC NAME AND ORIGIN

- *Dicerorhinus sumatrensis*
- *Dicerorhinus*: from the Greek *di*, meaning “two”; *ceros*, meaning “horn” and *rhinus*, meaning “nose”
- *sumatrensis*: referring to Sumatra (with the Latin *-ensis*, meaning a locality)

COMMON NAMES

- Sumatran rhinoceros



Javan rhino (*Rhinoceros sondaicus*) (Photo: T. Foose, Ph.D., *The Wilds*)



Sumatran rhino (*Dicerorhinus sumatrensis*) (Photo: T. Foose, Ph.D., *The Wilds*)

- Asian two-horned rhinoceros: the only two-horned rhino in the Asian region
- Hairy rhinoceros: refers to the long, shaggy hair found on the species in contrast to the other, hairless species.

DISTRIBUTION AND HABITAT

- Southeast Asia (primarily Indonesia and Malaysia)
- Montane rain forests

SIZE

- 600 to 800 kg (1,300 to 1,700 lb)
- .09 to 1.5 m (3 to 5 ft) tall at shoulder
- Larger horn 25 to 79 cm (10 to 31 in.) long

PHYSICAL DESCRIPTION

- Reddish-brown coat sparsely covered with long hair, pronounced in younger animals
- Fringed ears
- Two horns

LIFE HISTORY CHARACTERISTICS

- Browser
- Solitary with the exception of females with calves; males solitary but visit female territories to mate
- Sexually mature at 7 to 8 years of age (males and females)
- Gestation period 510 to 550 days; interbirth interval of 3 to 4 years

WHITE RHINOCEROS



SCIENTIFIC NAME AND ORIGIN

- *Ceratotherium simum*
- *Ceratotherium*: from the Greek *cerato*, meaning "horn" and *therium*, meaning "wild beast"
- *simum*: from the Greek *simus*, meaning "flat-nosed"

COMMON NAMES

- African white rhinoceros: from the Afrikaans word describing its mouth: *weit*, meaning "wide"
- Square-lipped rhinoceros: lacking a prehensile "hook"

DISTRIBUTION AND HABITAT

- Southern and central Africa
- Long- and short-grass savannahs



White rhino (*Ceratotherium simum*) (Photo: Knoxville Zoological Gardens)

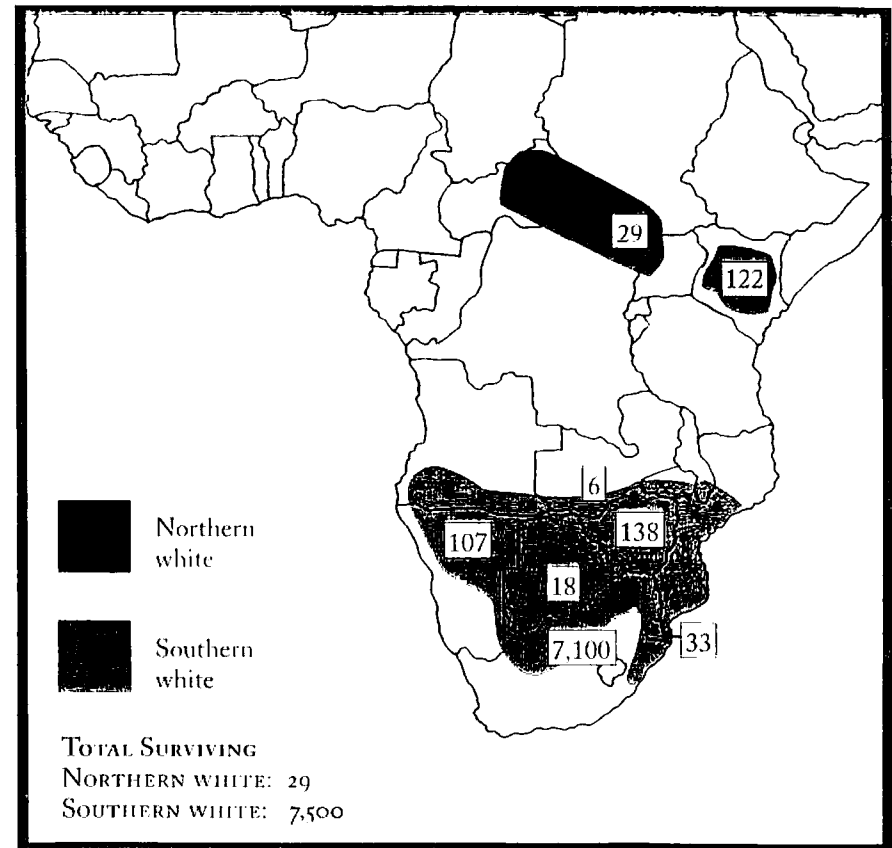


Figure 2. White rhino historical distribution and current country totals (Map: N. van Strien)

SIZE

- 1,800 to 2,200 kg (4,000 to 5,000 lb)
- 1.5 to 1.8 m (5 to 6 ft) tall at shoulder
- Larger horn 94 to 102 cm (37 to 40 in.) (northern subspecies), 94 to 201 cm (37 to 79 in.) (southern subspecies)
- Largest land mammal (after elephants) along with the greater one-horned rhino

PHYSICAL DESCRIPTION

- Neutral gray, almost hairless
- Two horns

LIFE HISTORY CHARACTERISTICS

- Grazer
- Semi-social and territorial; females and subadults rarely solitary; bulls typically solitary, though satellite males may reside within one another's territories
- Females sexually mature at 6 to 7 years; males at 10 to 12 years
- Gestation period approximately 16 months; interbirth interval of 2 to 3 years

BLACK RHINOCEROS



SCIENTIFIC NAME AND ORIGIN

- *Diceros bicornis*
- *Diceros*: from the Greek *di*, meaning "two" and *ceros*, meaning "horn"
- *bicornis*: from the Latin *bi*, meaning "two" and *cornis*, meaning "horn"

COMMON NAMES

- African black rhinoceros: Not black at all, the black rhino probably derives its name from the dark-colored local soil covering its skin from wallowing.
- Prehensile-lipped rhinoceros: The upper lip of the black rhino is adapted for feeding from trees and shrubs and is the best distinguishing characteristic.
- Hook-lipped rhinoceros: also referring to the prehensile lip

DISTRIBUTION AND HABITAT

- Sub-Saharan Africa
- Tropical bushlands and savannahs

SIZE

- 800 to 1,350 kg (1,750 to 3,000 lb)
- 1.4 to 1.7 m (4.5 to 5.5 ft) tall at shoulder
- Larger horn 0.5 to 1.3 m (1 ft 8 in. to 4 ft 4 in.) long



Black rhino (*Diceros bicornis*) (Photo: M. Fowler, East West Zoological Park)

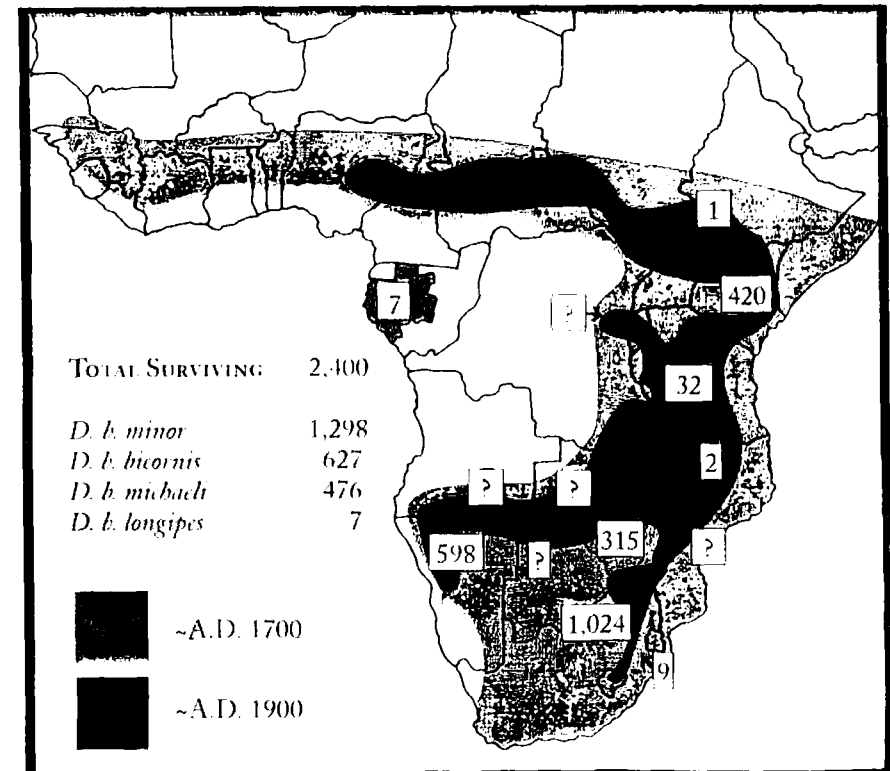


Figure 3. Black rhino historical distribution and current country totals (Map: N. van Strien)

PHYSICAL DESCRIPTION

- Gray to brownish-gray, hairless
- Two horns

LIFE HISTORY CHARACTERISTICS

- Browser
- Not as solitary as is commonly portrayed; adult females share overlapping home ranges; males usually solitary and possibly territorial
- Females sexually mature at 4 to 7 years of age; males at 7 to 10 years
- Gestation period approximately 15 to 16 months; interbirth interval of 2.5 to 4 years

THE CRISIS FOR RHINOS

In the middle of the last century, all five rhino species were widely distributed and most abundant throughout Asia and Africa. As of the close of this century, only about 12,800 rhinos of all kinds survive in the wild. Another 1,000 exist in captivity (Table 1). However, more than half these rhinos, both in the wild and in captivity, are of a single species, the white rhino, and of only one of the two distinct subspecies of this species. Of the other four species combined, fewer than 5,000 individuals survive. The situation is even worse because some of the species are divided into subspecies, which conservationists currently believe may be different enough that they should be conserved as separate kinds.

The Javan rhino is the rarest of the species, with a total population estimated at fewer than 100 in the wild and none in captivity. The Sumatran rhino has probably become the most critically endangered of all the rhino species and perhaps of any large mammal. While the Javan rhino is fewer in number and the black rhino has declined more rapidly in recent years, the combination of low numbers (only 400) and rapid decline (50% over the last 10 years) in the Sumatran rhino population is exceptional. The black rhino has suffered one of the most rapid declines (more than 97% in 25 years or slightly more than one rhino generation, perhaps 85% in just the last 10 years) known for a large mammal. The northern white rhino is the rarest distinct taxon of rhino and again perhaps of any large mammal: 29 in the wild, nine in captivity.

The distribution of the few surviving rhinos is also fragmented. Significant rhino populations survive in just 10 countries. It is also true that they survive in only about 40 major areas (national parks and wildlife reserves).

THE CAUSE OF THE CRISIS

As with all endangered species, loss of habitat is an important, but not the major, cause of the rhino's decline. The greater problem is overexploitation through poaching for the horn. The rhino is a spectacular example of a species that is disappearing much more rapidly than its habitat (in contrast to endangered species like the California condor or the spotted owl). The main use of rhino horn is in Chinese traditional medicine, in which it is the drug of choice to reduce fever associated with serious illness. It is also used as an aphrodisiac,

TABLE 1. The conservation status of the rhinoceros

Species or Subspecies	Wild Population ¹	Global Captive Population
Southwestern black rhino	625	0
Northwestern black rhino	30	0
Eastern black rhino	475	165
Southern black rhino	1,300	45
Total black rhino	2,400	210
Northern white rhino	29	9
Southern white rhino	7,500	630+
Total white rhino	7,500+	640
African rhino species	~9,900	850
Greater one-horned rhino	2,000	134
Javan rhino	<100	0
Eastern Sumatran rhino (Borneo)	<100	5
Western Sumatran rhino (Sumatra/Malaya)	300	16
Total Sumatran rhino	400	21
Asian rhino species	~2,900	155
All species	12,800	1,000

although the extent of this usage may have been exaggerated. A third market has been in the Middle East, where the horn is used to make dagger handles that confer social status. In recent years, with the end of the rhino in sight, yet another economic force has entered the picture. Rhino horn has been a speculator's commodity in the Far East to the extent that the speculation might be controlling the price more than the consumer market does.

The result of this excessive hunting is the drastically reduced and almost absurdly fragmented distribution of rhinos. The estimated 400 Sumatran rhinos are dispersed over at least 35 locations in southeast Asia in remnant populations so small that they have little hope of survival without intensive management.

Extinction pressure on the rhino has been occurring for some time. In fact, two of the species (the white rhino in Africa and the greater one-horned rhino on the Indian subcontinent) were almost lost around the turn of the century, but effective protection reversed this trend and kept most rhino populations reasonably unthreatened until after the second world war. Then rhino poaching resumed rampantly, especially during the 1970s and 1980s. The most spectacular decline in recent years has been suffered by the black rhino in Africa, down from 60,000 in 1970 to approximately 2,400 today.

As Box 1 indicates, Africa has been the backdrop for a domino effect as the rhino population has crashed in country after country due to poaching. Only South Africa, Namibia and perhaps Zimbabwe remain as rhino strongholds in Africa. The situation in South Africa is cause for particular concern. Eighty percent of all African rhinos (40% of black and 97% of white) live in South Africa. If the turmoil of political transition becomes severe, there could be yet another, perhaps the greatest of all, catastrophe for the African rhino. Appreciable poaching is already occurring in South Africa for the first time in decades. Similar to the African populations, the Asian rhino populations are confronted by increasing assaults (Box 2).

Rapid decrease in numbers due primarily to poaching is the major, but not the only, problem encountered in the conservation of rhinos. In some emerging terminology of modern conservation biology, there are "declining-population" paradigm problems. However, when populations become as small and fragmented as the rhinos', another set of threats to survival exist. These are the so-called "small-population problems" (i.e., the "small-population paradigm," Box 3).

CONSERVATION OF RHINOS

In the wild, it is obvious that rhinos must be intensively protected and managed if they are to survive. Wild sanctuaries for rhinos are becoming megazoo. Indeed, a spectrum of options is needed in a diversified strategy for rhinos. These options differ only in the level of intensive management required.

Zoos and other captive conservation centers are an important part of the spectrum. Zoos can play at least three important roles in rhino conservation:

- (1) providing reservoirs through captive propagation, (2) conducting research that

BOX 1. RHINO POPULATION DECLINE IN AFRICA

Country	Status
Uganda	The rhino, black and white, was exterminated during the 1970s.
Kenya	Numbers of black rhinos declined from an estimated 20,000 in 1970 to a low of perhaps 400 by the 1980s. (Numbers have stabilized and may be recovering, temporarily.)
Zaire	The northern white rhino was reduced from several thousand to a low of 16 by 1984.
Zambia	The 4,000 black rhinos in the Luangwa Valley were annihilated from 1980 to 1985.
Tanzania	Black rhinos declined from an estimated 5,000 to perhaps 200 in the late 1980s.
Zimbabwe	Fewer than 300 black rhinos survive from an estimated 1,700 just 5 years ago. From January to May of 1993, virtually all the 100 white rhinos in Hwange were killed by poachers. Moreover, the poaching occurred despite the fact that the horns of virtually all of these rhinos had been removed by the wildlife department to deter poachers. De-horning has been a drastic measure with very uncertain effects, as a number of de-horned rhinos have been lost and there is some evidence that removal of the horns does disrupt the rhino's biology.

BOX 2. RHINO POPULATION DECLINE IN ASIA

The second largest population (Manas) of greater one-horned rhinos in India has been decimated, and the largest population (Kaziranga) is under increasing assault. Many rhinos are also being poached in Nepal. Until recently, India and Nepal were among the success stories in rhino conservation, but now the trend may be in peril.

Illegal trade of Sumatran rhino horn continues in significant numbers, and the species has virtually vanished from some "protected" areas where populations had been most dense.

The population of Javan rhinos in Indonesia is stagnating, and one conclusion is that poaching is preventing increase.

will help rhinos in the wild as well as in captivity, and (3) educating all levels of society about the problem and attracting support, financial and otherwise.

However, it must be emphasized that captive populations and programs are not an end in themselves. The purpose is to support survival or recovery of the species in the wild.

As the rhino crisis intensifies, captive propagation becomes more and more important. However, captive breeding for conservation is rather different in its objectives from what was once the case and what is now the case with highly controlled breeding programs for other species such as domestic horses and dogs. The goal is not to produce the "best" rhino by selective breeding, but rather to ensure that captivity changes the rhino as little as possible so that it emerges from the captive "ark" in as natural a condition as possible. Achieving this objective requires that rhinos be managed genetically in captivity.

Zoos are attempting to manage and propagate endangered species through highly organized and scientific programs. In the United States and Canada, these programs are known as Species Survival Plans (SSPs). SSPs have traditionally been managed by Species Coordinators and Management Committees. More recently, Taxon Advisory Groups (TAGs) have emerged. Among other functions, TAGs provide strategic perspectives and technical advice for SSPs.

Each SSP develops a masterplan for management and propagation of its species. These masterplans specify how many rhinos from the wild are needed to establish a captive population with a sufficient sample of the gene pool. The plans also indicate how large captive populations must become to avoid genetic and demographic problems. They also then indicate who should be mated with whom to maximize preservation of genetic diversity. SSP-type programs are now in progress worldwide in major regions of the zoo world, although the titles and acronyms change, producing a real alphabet soup. These regional SSPs cooperate and coordinate through what is known as the Global Captive Action Plan (GCAP) for rhinos as a family and as Global Animal Survival Plans (GASPs) for each species.

Captive management, however, is not all genetics and demography of populations. Basic husbandry, how to maintain healthy individuals and induce them to breed, is fundamental. There are major challenges for rhino husbandry in captivity. Indeed, rhinos have presented some of the most formidable challenges of any species for captive husbandry. As a consequence, all taxa of rhinos are in some degree of demographic difficulty in captivity. The demographic problems are causing genetic difficulties because some lineages are at risk of being lost because their representatives are not reproducing. Clearly, husbandry, demography and genetics interact; and all three are crucial to the conservation of rhinos, especially in captivity. Currently, husbandry problems may be impeding intensive management of rhino species (Table 2). Specific problems include poor survivorship and high mortality, poor reproductive success and a fundamental lack of knowledge regarding basic rhino biology.

BOX 3. THE RHINOCEROS AND THE SMALL-POPULATION PARADIGM

Small populations are vulnerable to catastrophes like epidemic disease and natural disasters. (The last population of Javan rhinos in Indonesia lives in the shadow of Krakatoa Volcano, which erupted spectacularly in the 1880s.)

Small populations are subject to deleterious fluctuations in demographic performance. For example, a significant demographic problem has been developing with the SSP population of the eastern black rhino (*Diceros bicornis michaeli*). From 1990 to 1995, 15 of the 18 surviving individuals born in the North American population were males, and only three were females. This skew in the sex ratio will probably destabilize the population demographically. The future of the population may be in jeopardy.

Small populations lose genetic diversity and become inbred. Genetic diversity is needed both for the vigor of individuals and for the ability of populations to adapt as their environments change rapidly under human influence. In small populations, gene pools become gene puddles that evaporate into extinction. Moreover, the effects on small populations interact. Small size causes inbreeding, which causes reproduction and survival to decline, which produces yet a smaller population. The result is an extinction vortex. The Javan rhino may be in such a vortex right now.

POOR SURVIVORSHIP/HIGH MORTALITY

At least two rhino species, black and Sumatran, have problems with poor survivorship/high mortality under intensive management. Rhinos don't always prosper in captivity. The black rhino in particular has been afflicted with many health problems (e.g., hemolytic anemia, severe ulcers on skin and mucous membranes, liver dysfunction) that all seem to be related to and to derive from a peculiarity of the red blood cells. These cells seem to be low in energy levels and deficient in enzymes. This condition may be an adaptation against blood parasites in the wild but becomes a serious health problem when rhinos are placed under stress, particularly chemical stress, as they often are in captivity or under other intensive management.

POOR REPRODUCTIVE SUCCESS

Reproduction in all four of the species that have been maintained in captivity is less than optimal. In general, greater one-horned, black and, to a lesser extent, white rhinos reproduce well in captivity if certain (the "right"?) conditions are provided. But what exactly are these conditions? Another species, the Sumatran, has not reproduced in recent times under intensive management. For no species of rhino in captivity is reproduction reliable or routine.

POOR UNDERSTANDING OF BASIC BIOLOGY

Compared with many other groups of organisms under intensive management, the basic (nutritional, reproductive, behavioral) biology of rhinos is poorly known. Nutritional problems are suspected to be of particular significance to the health and perhaps the reproductive difficulties of rhinos. Behavioral problems including stress are probably also interfering with successful husbandry. Various physiological and psychological stressors are believed to be underlying causal factors for many of the specific disease syndromes in rhinos.

In recognition of husbandry problems, a major goal of SSPs and the TAGs that facilitate them is the production of husbandry manuals, documents of equal importance to the SSP masterplans for successful management and propagation of species in captivity.

THE FUTURE

It is ironic that long before the bison, rhinos were native North Americans. For more than 40 million years, rhinos prospered in North America but then became extinct. Since then and until recently, rhinos prospered in Africa and Asia. Now rhinos are becoming extinct on those continents but have returned to North America and Europe as refugees (and to Australasia as immigrants). The future for the rhinoceros in Africa and Asia lies not in the survival of native rhinos, but in the recolonization sometime in the next century by descendants of the refugees and immigrants from North America and other continents with zoos.

Captive populations can contribute positively to the conservation of rhino species, but only if captive stewards of the rhino know how to provide improved and proper husbandry during the period of intensive management rhinos will require over the next several decades at least.

TABLE 2. The status of captive rhino populations within the AZA (Foose & Reece, 1994)

Species	Status
Eastern black rhino	This species reproduces rather reliably in captivity, but management has not maximized the reproductive potential, and health/husbandry problems continue to negate the breeding success that has occurred. As a result, the species is in a demographic crisis; thus, it is imperative to increase reproduction through improved management.
Southern black rhino	Reproduction in this species has been moderate, but many of the births in captivity were actually conceived in the wild. Captive reproduction may be on the increase, but mortality has been high (although much is probably due to toxin exposure in Africa).
Southern white rhino	Reproduction in this subspecies has been very uneven, with only a few facilities, particularly those able to maintain larger social groups, propagating well. The majority of rhinos in institutions are not breeding at all; thus, the population is in demographic and genetic crises. The age structure of the population is senescing, and not enough of the original wild-caught founders have reproduced.
Northern white rhino	The program for this subspecies has been a failure to date. Only nine individuals survive, and reproduction in captivity has been limited (none in North America and none anywhere since 1989). Intense efforts are in progress to induce reproduction, but the prospects are limited at best.
Greater one-horned rhino	This program has been relatively successful with the annual population growth rate about equal to what is occurring in the wild. However, much of the reproduction to date has been by a limited number of breeders; thus, the genetic diversity in the captive-born population is inadequate. Prospects do seem good for recruitment of more breeders from the existing captive population.
Sumatran rhino	This program has been a failure to date with numbers of individuals and founders low, no reproduction occurring and the death rate high (30% of those imported).

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(Photo: Knoxville Zoological Gardens)