



This month ZOONOOZ follows creatures great and small, from rhinos of differing patterns and hues to butterflies that have homesteaded a passion flower vine. Botanical Side adventurers embark on a voyage to follow sea beans and sea hearts—seeds set adrift.

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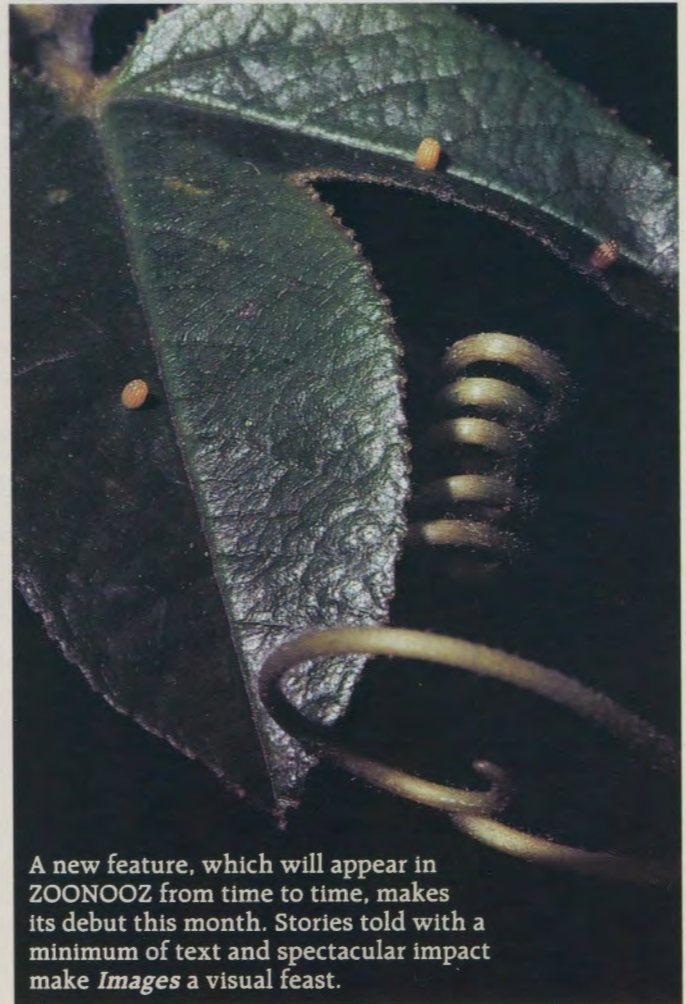
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COVERS

Front: Jorhat, a young Indian rhino, nestles against his mother's "armored" side. Jorhat was born to Jaypuri and Lasai on May 1, 1983. Last September he was sent on breeding loan to the Lowry Park Zoo, Tampa, Florida, to begin a new dynasty. San Diego Zoo photo by Ron Garrison.

Back: An Asiatic tree frog *Polypedates leucomystax* has the last laugh. San Diego Zoo photo by Ken Kelley.

Opposite: Australian stone curlew *Burhinus magnirostris*.



A new feature, which will appear in ZOONOOZ from time to time, makes its debut this month. Stories told with a minimum of text and spectacular impact make *Images* a visual feast.

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- Generate interest in and membership in the Society.
- Contribute to the reader's knowledge of exhibits, research, education, animals, plants, and other matters pertinent to the Society's purposes.

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**San Diego Zoo and Wild Animal Park
Spring Hours**

March 6 through May 31

Gates open: 9 A.M.

Gates close: 4 P.M.

Off Grounds/Zoo: 6 P.M. Off Grounds/Park: 5 P.M.

OILING THE WHEELS

A couple of years ago at an executive team retreat, a member of my administrative support group said, "I don't need to be a big wheel. I'd rather put the oil on the wheels to keep them rolling." There certainly is no doubt in my mind that without our clerk-typists, receptionists, secretaries, office managers, and assistants our organization would grind to a halt.

When a job classification study was conducted by the Society a while ago, the consultants were stymied by one category—secretaries. The support teams at the Zoo and the Wild Animal Park have such a multitude of unique and varied tasks and knowledge that it could not be covered in a single description.

All of the support group members have basic office skills, most now including sophisticated techniques such as operation of personal computers, word processors, facsimile machines, voice mail systems, and computerized photocopiers. Because our facilities are like small cities, however, our support people have to learn many specialties.

For example, our researchers, veterinarians, and pathologists require medical secretaries with knowledge of a multitude of exotic species, their diseases, and their treatments.

Curatorial secretaries have to know the intricacies of shipping, quarantining, and insuring birds, mammals, and reptiles in all parts of the world. One is even our China consultant, speaking several Chinese dialects. They all field calls from the public about local wild animals and must know the answers. *What do I feed an orphaned mockingbird? How do I keep deer away from my orchard? Can I bring in an injured raccoon? What do I do about the rattlesnake in my garage?*

My personal support team is at the hub of almost everything that goes into running zoological facilities. In addition to meeting my stated (and often unstated) needs, they coordinate and record the Society's committee and Board meetings; write letters, articles, talks, and reports; arrange for, and make welcome, V.I.P.s from other zoos, entertainment and the arts, and governmental entities; coordinate our long-range strategic plan; help me tend our budget; coordinate national and international conferences; act as paralegals; help maintain the Society history; and deal tactfully with members, donors, and the general public—in good moods and bad. In short, if I were away for a few weeks, things would operate smoothly. If they were all gone for a week . . . I hate to contemplate it.

The same can be said of the support people in all of our departments. Each requires special knowledge, such as education, group sales, public relations, marketing, food service, merchandising, human resources, horticulture, architecture, finance, development, security, and construction and maintenance. They all work—usually quietly, cheerfully, and efficiently—to support us and our collections, facilities, programs, and services, mostly without much official recognition. So, let this be my tribute to our administrative supporters. Indeed, they are the wheels within the wheels that keep us rolling along.

Douglas G. Myers

Executive Director

San Diego Zoo: R. Garrison





The Rhino: Final Episode or New Chapter?

Sharon Joseph
KEEPER

A natural association has developed between the Wild Animal Park and the rhino. The rhinoceros, whose image has been adopted as the Park's emblem, symbolizes much of what the Wild Animal Park is all about in

terms of captive propagation and conservation.

Although one of the Park's biggest success stories is the captive propagation of a phenomenal, unprecedented 75 southern white rhinos, there is a more subtle but equally significant

success story unfolding with the endangered Indian, or greater one-horned, rhinoceros. Captive propagation of the Indian rhinoceros at the Wild Animal Park has not been as successful as with the southern white rhinoceros in terms of num-

bers, but such efforts may one day be just as effective in snatching this species from the jaws of extinction.

There are presently five existing rhino species: two African species—the white or square-lipped rhino and the black or hook-lipped rhino, and three Asian species—the Javan, the Sumatran, and the Indian rhino. All species of the rhinoceros are either threatened or endangered in their natural habitats, and the numbers of most have been reduced by 90 percent or more in the last 20 years.

The present-day Indian rhino is the most prehistoric in appearance of the five rhino species; it can be traced back 10 to 25 million years and has remained almost unchanged for nearly a million years. The Indian rhino ranges in size from 4,500 to 6,000 pounds or more, stands as high as 6 feet tall at the shoulders, and can reach 13 feet in length. The feature that most obviously sets this species apart from other rhinos is the armor-plated appearance created by skin folds that divide the bumpy skin into large, studded "shields." While the function of these skin folds is not fully understood, it is suggested that they may play a role in temperature regulation by serving to increase the surface area of the

skin. The Indian rhino is also equipped with a prehensile, or grasping, upper lip used for browsing on shrubs and trees. Like other rhinos, its eyesight is poor but the other senses are well-developed; it is said that rhinos can smell a human from a distance of 800 yards. Moving with unexpected grace and speed, Indian rhinos can run at speeds up to 25 miles per hour and are skillful swimmers and divers—it is not unusual for them to cross wide rivers. Like other rhinos and equids, Indian rhinos are monogastric herbivores, possessing a single-chambered stomach (unlike cud-chewing ruminants such as cattle, antelope, and deer). Indian rhinos ingest as much as 65 to 90 pounds of dry matter per day. Their diet in the wild includes grasses, reeds, twigs, shrubs and trees, and agricultural crops if given the opportunity. Their captive diet at the Wild Animal Park consists of hay, compressed alfalfa pellets, grain, fruits and vegetables, and freshly cut acacia browse.

All of the Asian species of rhinos are essentially solitary, with males and females coming together only for courtship and mating. Mornings and evenings are reserved mainly for feeding, while much of the rest of the

day is spent sleeping. Indian rhinos remain near water, usually in grasslands or swamps, where they bathe and wallow daily. The young remain with their mothers until the birth of a subsequent offspring is imminent, at which time the first calf will be driven off—sometimes rather aggressively, by the female. The inter-birth interval in the wild may be as long as three years.

Adult males are territorial and are particularly intolerant of other males; their razor-sharp, tusklike incisors make effective weapons when doing battle. Indian rhinos primarily bite and slash at one another and do not rely solely on their horns.

Historically, the Indian rhinoceros once ranged over the whole of northern India. Today this range has been reduced to parts of northeastern India and Nepal, where they dwell largely in national parks. Mohammed Khan, of the Malaysia Department of Wildlife, estimates rhino populations of 1,424 individuals in India and 380 in Nepal as of October 1988. The great majority of the rhinos live in Kaziranga National Park, which may be the finest wildlife reserve in all of Asia. In addition to the nearly 1,000 Indian rhinos, Kaziranga is also home to 8,000 hog deer, 900 wild pigs, 800

Young Jumia, born January 18, 1986, seeks some attention from her mother, Jayyuri.



San Diego Zoo: R. Garrison

Precocious Pandu shows an interest in browse only 11 days after his birth at the Wild Animal Park on August 8, 1980. In July 1985 he was shipped on loan to the National Zoo in Washington, D.C.



San Diego Zoo: R. Garrison

Asian elephants, 700 swamp deer, 660 water buffaloes, 100 barking deer, as well as tigers, leopards, sloth bears, Indian otters, gaurs, and monkeys.

Loss of habitat and uncontrolled killing of rhinos to supply the commercial demand for rhino horn and other body parts are the two major threats to the Indian rhino population. These threats are closely inter-related because as habitat is reduced, the number of rhinos that can be supported is reduced, and the remaining animals become even more vulnerable to poaching pressure. Loss of habitat from deforestation contributes heavily to a declining population. The agricultural, natural resource, and living-space needs of an ever-increasing human population serve to shrink the natural habitat of all species of rhinos.

Rhinoceros horn is prized for a variety of reasons, all of which contribute to the continuing slaughter of both the Asian and the African species. Rhino horn plays a part in traditional Chinese medicine—practiced

today much as it was 1,000 years ago. Pharmacists in Singapore, Hong Kong, Macao, and Taipei prescribe pulverized rhino horn for fevers, headaches, arthritis, impotence, and other infirmities. None of the medicinal properties or aphrodisiacal powers attributed to rhino horn have been substantiated by the scientific community. Nor have any of the qualities ascribed to the animals' flesh, hide, blood, milk, or urine been found to have any merit. Yet superstition and tradition continue to fuel the illegal rhino trade. Additionally, rhino horn is sought after for making dagger handles, considered a status symbol in parts of the Middle East, and the skin is made into shields by Asians, Africans, and Arabs. While all rhino species suffer because of the demand for body parts, the Asian species are prized above all as being the most powerful and valuable. In Singapore, recent retail prices for a kilo of African rhino horn were \$9,876, while a kilo of Asian rhino horn was valued at \$19,170. The average Indian rhino horn weighs 720

grams, for which a poacher receives about \$875 from a middleman who sells to a trader who, in turn, transports the horn to Calcutta for export. The profits from this illegal enterprise increase greatly each step of the way, and the organized operation of poaching and smuggling syndicates in India is widespread. The wholesale value of Indian rhino horn in Southeast Asia and the Far East is \$6,000 to \$9,000 per kilo, while the skin of an Indian rhino brings about \$500 per kilo.

In the face of an ever-shrinking wild population, efforts to breed the Indian rhinoceros in captivity become even more important. In 1925, the first captive birth of an Indian rhino was recorded at the Calcutta Zoo. Prior to that, no attempts had been made to breed this species; it was felt that new specimens could easily and endlessly be taken from the wild for purposes of exhibition. Modern-day captive breeding success with the Indian rhino was pioneered by the Basel Zoo in Switzerland, where a breeding pair of the animals was established in the early 1950s. In 1956, Basel's efforts were rewarded with the first surviving Indian rhino calf bred and born in captivity. Zoo officials there recorded a gestation period of 474 to 486 days and a growth rate for the calf of 4½ pounds per day.

The original pair of rhinos in Basel's world-famous breeding colony, male Gadadhar and female Joymothi, produced a male calf in 1962 that was destined to become the cornerstone of San Diego's captive breeding program. Lasai was received at the San Diego Zoo on October 12, 1963, when he was 13½ months old. His name, which in an Indian dialect means "chubby" or "fat one," is no misnomer: as an adult, Lasai weighs in at just under four tons! Jaypuri, a female wild-bred in Assam, India, but raised on a game preserve, arrived at the San Diego Zoo on February 28, 1965, to join Lasai. At that time, she was 15 months of age and weighed 1,100 pounds. These two animals were subsequently moved to the Wild Animal Park when it opened in

1972, where they have formed the nucleus of the Park's breeding group and have collaborated on seven offspring to date. A total of 10 offspring have been produced by 2 females at the Park, with an 11th calf due within weeks and another in February 1990. A third female has just recently become reproductively active and should, by now, be pregnant with her first calf. While a select few of these calves remain at the Park, most are placed in other institutions because of space considerations and to maintain genetic variability in captive stock. Indian rhino calves born at the Wild Animal Park have been placed at other zoos in the United States and in Seoul, South Korea; there are further plans to send some to Singapore and to China. In 1982, a milestone was achieved with the first second-generation captive birth of an Indian rhinoceros in the Western Hemisphere. In September of the following year, a five-year-old male, Rabha, was received from the Hyderabad Zoo in India. Rabha was totally unrelated to any of the North American animals, making his arrival significant not only to San Diego's

breeding group, but also to the captive collection as a whole, because of his potential for greatly increasing the genetic variability in a relatively small population. The present North American captive population of Indian rhinos consists of only 18 males and 16 females; worldwide there are less than 100 captive animals. In December 1987, Rabha was successfully mated with our female Gaimda, and his first calf (her fourth) is the one expected imminently.

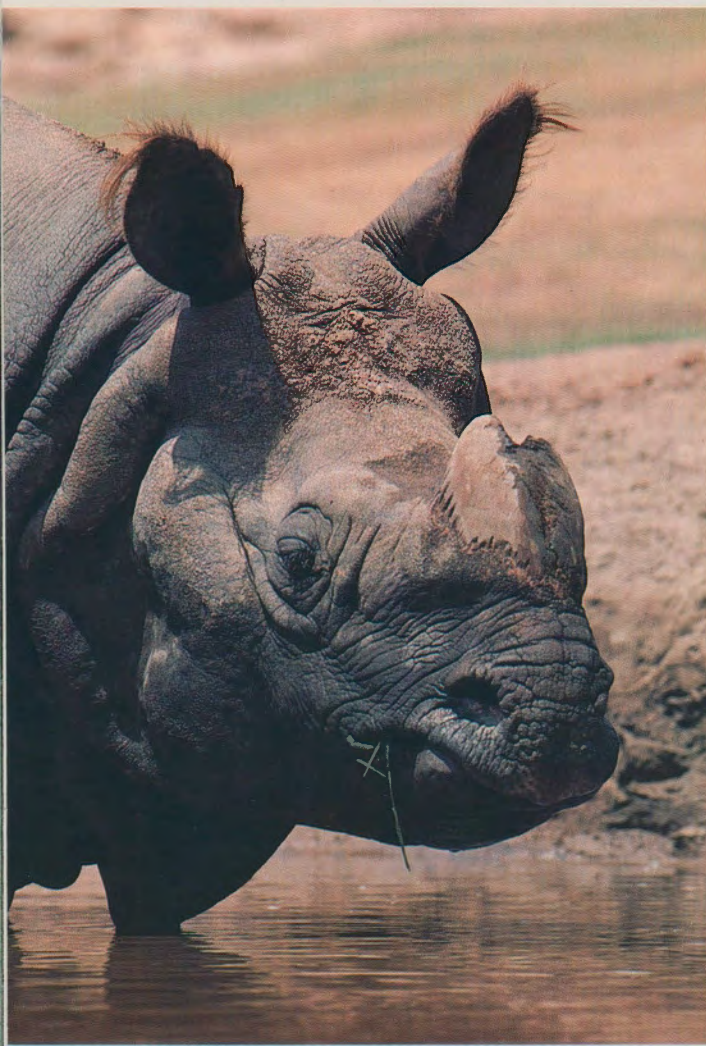
With the addition of a second male to the group, along with the maturation of some of the younger females, the Park anticipates even greater success in the captive propagation of this species.

Breeding between Indian rhinos is apt to be a violent affair and can be a source of concern for the animal care staff. Both male and female are likely to inflict and receive wounds during the courtship. The animals alternately chase each other, biting and slashing with those menacing incisors. Wounds are generally superficial in nature—not severe enough to require veterinary attention. Male rhinos are particularly bold at breeding time and, in the wild, are even known to charge elephants. In years past, there was an Indian gaur bull at the Wild Animal Park which, not once but twice, made the mistake of interfering with Indian rhino male Lasai's breeding behavior. The one-ton wild bovid, nicknamed Lydekker by keepers, was no match for an angry rhinoceros and became a field surgery patient for veterinarians, receiving more than 150 stitches to close wounds inflicted by Lasai. The aggressive interaction between male and female Indian rhinos can last for a period of hours but eventually results in receptivity toward each other. Experience has taught us that this is normal breeding behavior for this species and that any intervention from worry on our part would be disruptive.

Given the lengthy gestation period of approximately 16 months and the size of the calves (about 150 pounds), one would not think of the pregnancy of an Indian rhino female as being easy; but our experience has been that calving in this species is accomplished quickly and with ease. One calf, which was positioned in a posterior presentation (not as unusual in rhinos as in other hoofed-stock species), was delivered and on the ground only 11 minutes after the cow's water bag had broken. Perhaps this is because the calf's size, relative to the size of the mother, is proportionately small. Calves generally stand within an hour of birth and nurse at a few hours of age. They are wobbly and unstable for the first 48



Browsing and basking in a favorite water hole can be blissful.



San Diego Zoo: R. Garrison

hours, after which their activity level increases dramatically.

We have measured growth rates in our calves of up to five pounds per day, which corresponds to data from the Basel Zoo. Dams and calves are generally isolated in a maternity facility for up to six months, at which time they join the rest of the rhino herd and 280 other animals of mixed species in the 62-acre Asian Plains enclosure. The rhinos are highly visible from the monorail because of their tremendous size, distinctive appearance, and customary close proximity to the monorail track.

Calves can be artificially weaned as early as six months of age, but otherwise will continue to nurse as long as mother will allow, sometimes until the time another calf is born. Young rhinos begin to sample solid food at one month of age, steadily increasing their consumption of solids from that point. The combination of mother's milk and solid food produces weight gains of a healthy 100 to 120 pounds per month during the first year of life.

In much the same way that cooperative, global efforts are being mounted to save other endangered species, the Zoological Society of San Diego works within an international scientific community to save the In-

Plans are underway at the Wild Animal Park for facility expansion in order to accommodate more rhinos. This will allow the herd to be split into two breeding groups. Currently, the Park houses three male and four female Indian rhinos.



San Diego Zoo: R. Garrison

dian rhinoceros. Currently, significant research is being conducted by the Zoological Society of San Diego and by the Zoological Society of London. Under the auspices of San Diego's Center for Reproduction of Endangered Species (CRES), a great deal of research has been done on the reproductive physiology of the Indian rhino. The concept of characterizing hormone profiles and estrous cycles by measuring the types and amounts of hormone metabolites excreted in the urine was pioneered at San Diego. This method of endocrine monitoring is helpful in assessing reproductive status, diagnosing ovarian dysfunction, timing and/or controlling ovulation, and for early pregnancy detection. Collecting, or attempting to collect, daily urine samples from the Indian rhino cows has been a longtime practice for keepers at the Park. As one can imagine, this is a challenging, sometimes humorous task that can involve a good deal of time spent trailing after a rhinoceros with a paper cup attached to a long pole. The rewards of this urine collection make it time well spent; both theoretical and practical information have been added to the body of knowledge on this species. One practical application of such endocrine monitoring involves Jay-

puri, a female at the Park who has borne seven offspring. Puzzled that she aborted two fetuses after having successfully raised several offspring, members of the CRES research team determined through urinary endocrine analysis that Jaypuri's progesterone level (essential to maintain pregnancy) had inexplicably dropped nine months into the last ill-fated pregnancy. Jaypuri is currently pregnant, with delivery expected in February 1990. Consistent collection of urine samples by keepers could help to avoid another aborted pregnancy by detecting inadequate progesterone levels in time to supplement Jaypuri with appropriate hormone compounds.

Other significant research being conducted by CRES may be useful in both wild and captive situations and may benefit other rhinoceros species as well. Genetic research on many endangered species including, but not limited to, rhinos is the province of CRES's Dr. Oliver Ryder. Artificial breeding strategies such as artificial insemination and embryo transfer may be employed in the future, as a handful of researchers work with a handful of rhinos to secure the survival of their species.

In December 1963, Dr. George H. Pournelle, then curator of mammals

Techniques for Rhino Repair

At the same time that the Park's animal care staff has been refining husbandry and management practices for the Indian rhino, the veterinary staff has been increasing its expertise in working with this rare mammal. One particularly interesting case involved a cow that had been injured in a confrontation with another rhino and had sustained a broken leg—a situation in which a host of logistical problems can arise. Under the guidance of Dr. James Oosterhuis, the animal was successfully anesthetized—no small feat considering that the risks are great because of scant knowledge of Indian rhino physiology and given the extremely sensitive nature of the drugs necessary to accomplish such an immobilization. A morphine derivative compound, approximately 1,000 times more powerful than morphine itself and lethal to humans, is used. Dosages are weight-based, with an extremely low tolerance for error. A block-and-tackle assembly, suspended from the ceiling of the patient's stall, was used to assist the rhino in standing and to provide support so that the required medical procedures could be carried out. An ingenious cast, formed of re-bar (the steel reinforcing rods used in masonry construction), was designed and fabricated by Park Welder Brian Clague and applied by veterinarians. Sadly, it was subsequently necessary to euthanize the animal because of internal injuries suffered in the attack, the extent of which were not fully apparent until autopsy. Still, this is an example of how a well-trained, experienced, and creative staff can collaborate on the care and handling of a species that can prove problematical.

for the San Diego Zoo, spoke of the rhino populations as being "dying remnants of a once widespread and highly successful group of mammals" and went on to say that "recent population studies indicate all too clearly that the last page of the final episode is being written in the 60-million-year history of these spectacular beasts."

Twenty-five years have elapsed since that bleak prognosis, and the Indian rhinoceros is still in peril. Speaking of all species of rhinos today, Dr. Esmond Bradley Martin, a rhinoceros expert affiliated with the World Wildlife Fund, reiterates that "an animal that has inhabited the earth for some 60 million years is now reduced to a few thousands that cling onto survival in little pockets of bush and jungle set aside for their protection. And even there they are being relentlessly hunted, trapped and killed."

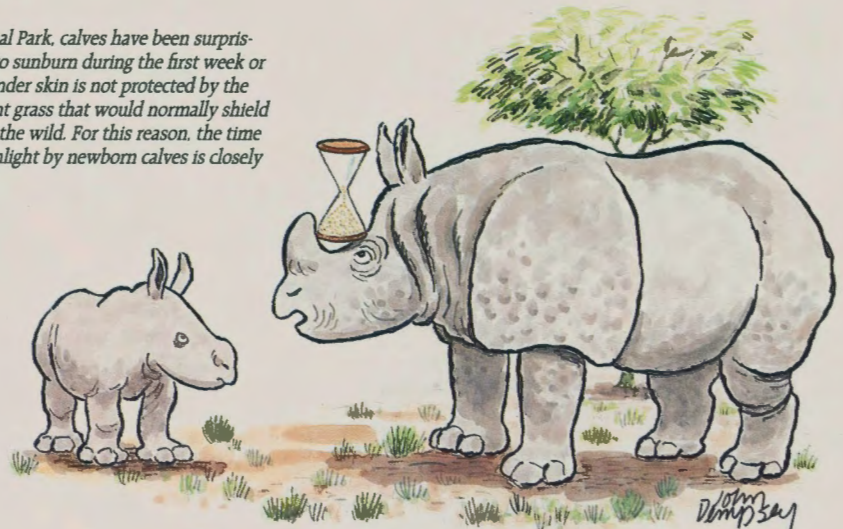
At the same time, Dr. Martin also offers some hope and perhaps even optimism for the preservation of the Indian rhinoceros. There are positive battles being waged and won in the war to save the Indian rhinoceros as well as other species of rhinos from extinction. According to Dr. Martin, who has dedicated most of his professional career to halting rhino exploitation in all forms, the quantity of new rhino horn reaching the world market may be dropping. Quantities dropped from eight tons per year from 1972 to 1978 to four tons per year from 1979 to 1982. So far, neither the demand nor the price for rhino horn has increased appreciably in recent years. In 1979 and 1980, Hong Kong and Japan, respectively, banned importation of rhino products. Recently, the use of saiga antelope horn in powdered form has more often been replacing the use of rhino horn as a fever-reducing agent in the Chinese pharmaceutical trade. (Until such time as the superstitious use of animal parts in traditional Chinese medicine is overcome, the currently plentiful saiga antelope represents a preferable, if also unsatisfactory, source of powdered horn.)

Of late, publicity and education about the plight of rhinoceroses in Africa and Asia have been effective in reducing the demand for rhino products. Vigorous measures are being taken by the governments of India and Nepal to protect their remaining rhinos. In some cases, relocation projects have been carried out in order to move more of the rhinos into national parks and to redistribute animals in small population pockets in order to increase genetic variability.

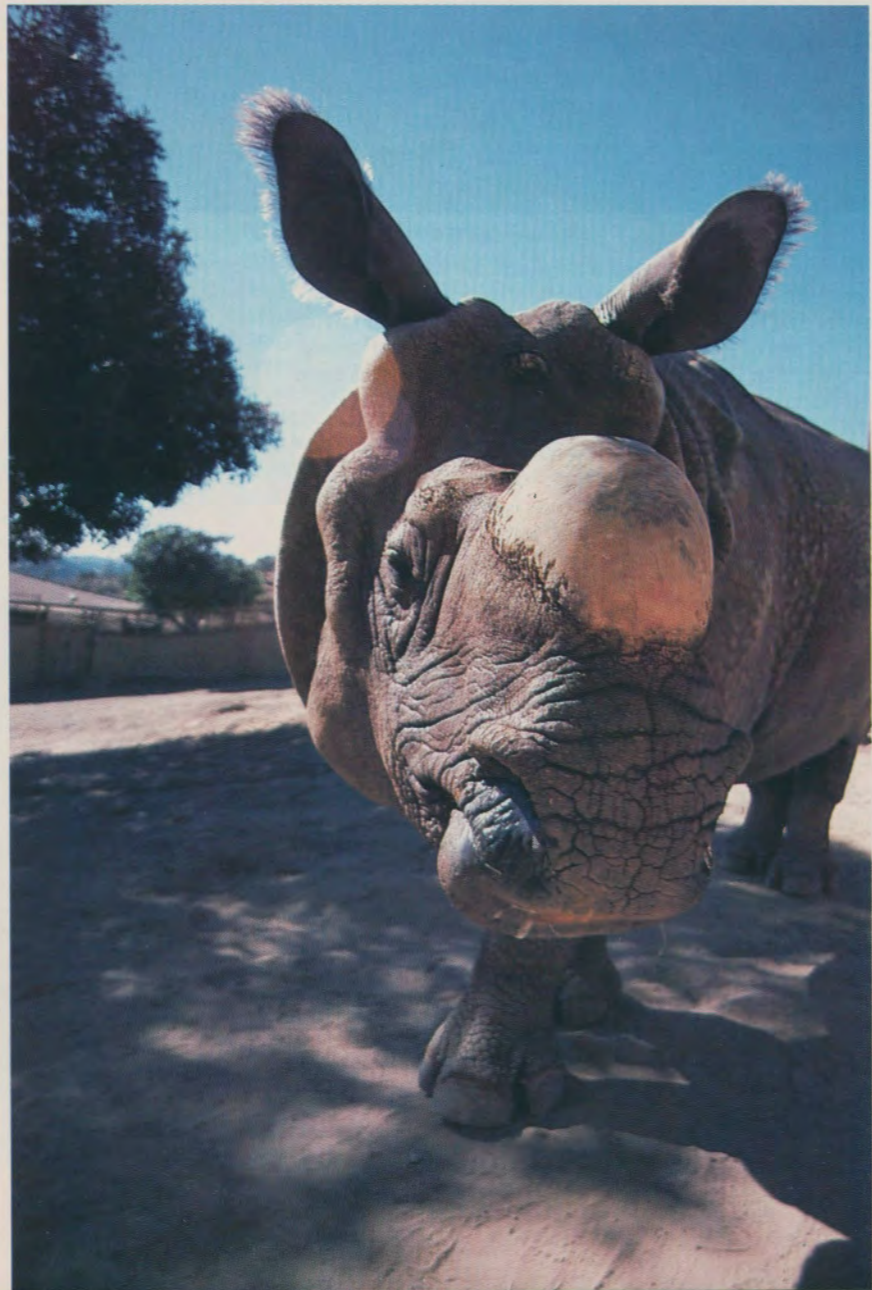
So, though progress is being made, 25 years after George Pournelle's

prophetic statements, conservationists still struggle to accomplish that all-important first step in solving the plight of the world's rhinos—world awareness. **ZNZ**

At the Wild Animal Park, calves have been surprisingly susceptible to sunburn during the first week or so of life. Their tender skin is not protected by the dense, tall elephant grass that would normally shield them from sun in the wild. For this reason, the time spent in direct sunlight by newborn calves is closely monitored.



"Time to get out of the sun, honey."



San Diego Zoo: C.W. Racicot

Rabha is male of the moment in the Wild Animal Park's Indian rhino herd. He has introduced a new bloodline to the Park, and his first offspring is due by mid-April. By the end of the month his youngster will probably be on view to the public.