



# KING OF THE MARSH

*Research into  
the riddles of rhino  
society may help  
Nepal save an  
endangered giant*

By Eric Dinerstein

**W**INTER fog blankets the sea of elephant grass in Nepal's Chitwan National Park, reducing visibility to less than 25 feet. A hog deer spooks in alarm before us and launches himself into the 16-foot-tall canes. I stand on the back of our oldest elephant, Chanchal Kali, hanging onto the rope as she pitches and sways. Behind me, 15 domestic elephants and their drivers bob along. Somewhere ahead of me is our formidable quarry, one of the most charismatic and peculiar animals ever to walk the planet.

Suddenly, through the tall grass and dawn mist, I spy a huge beast sleeping in a small clearing. Wisps of steam rise from its nostrils. We sneak closer, hoping not to rouse this leviathan from its slumber. We have found a greater one-horned rhinoc-

**Like a massive throwback to another age, a greater one-horned rhinoceros cools in a wallow. No more than 1,500 of the animals remain in India and Nepal, but rescue operations there are underway.**

eros, the fourth largest of all terrestrial mammals. But is it the individual we had come to study? A look through binoculars reveals a cut on the large bull's left ear, telling us that, indeed, we have found our rhino.

This massive creature, we knew, would give us added insight into how rhinoceros societies are organized. More than that, it would help us answer one of the most critical questions facing biologists concerned with preserving any endangered species: are enough animals left, carrying sufficient genetic differences in their bloodlines, to ensure long-term survival of the species?

I whistle softly to the other elephant drivers and they quietly hustle their charges into a circle around the slumbering behemoth.

When everyone is in place, Hemanta Mishra, the supervisor of our project, loads a tranquilizer gun. But before he can get close enough to shoot, the rhino wakes, snorts defiantly and crashes off into the gray morning.

Trapped in our circle of pachyderms, how-

ever, the big beast, a male known to us as M016, or Cut Ear, cannot get far. Hemanta moves in, raises the gun and fires a dart into the animal's hindquarters. The rhino remains standing for ten minutes, gamely trying to fight off the creeping effect of the narcotic before slumping to the ground.

We jump off the elephants and set to work. Like Lilliputians on a Gulliver, we swarm over the sedated giant, pulling out the dart, covering the rhino's ears and eyes, and slinging a radio transmitter around his neck. We also record horn length, tail length and more than 25 other measurements in between.

Two workers collect blood and a tissue sample so that back in the lab we can compare blood proteins to determine the genetic health of Chitwan rhinos. The absence of genetic variability can put a population in jeopardy of extinction since animals which are nearly identical are less likely to survive an epidemic or a sudden change to their environment. Moreover, large mammals are assumed to be more vulnerable to extinction because they are thought to carry less genetic variability than smaller mammals. Our blood exams will test this assumption.

Finally, three staff members lift Cut Ear's massive head and pry open his jaws



to examine his teeth. Periodic dental exams of male rhinos hold the key to understanding the species' social organization. Of greatest interest to us this morning is the condition of Cut Ear's tusks, or lower incisors. These teeth, we'd discovered, rather than the fabled horns, are the primary weapons used in clashes between males. A big bull with appropriate dentition can maintain his position as dominant male in a territory packed with breeding females. Cut Ear's tusks, we find, are sharp and unbroken.

The role of the teeth was just one of the important observations we had made while studying the greater one-horned rhinoceros in Royal Chitwan Park in Nepal. With support from the Smithsonian Insti-

tution and His Majesty's Government of Nepal, our staff of 25 field workers, backed by five elephants, had been radio-collaring and observing Cut Ear and the rest of the population for four years. Our goal was to answer some basic questions: how many individuals live in the park, how large an area do rhinos need to survive, which males get to breed, and which reign dominant and for how long? We also wanted to see how social organization was linked to the genetic makeup of this rare creature and how animals in a small population might avoid inbreeding.

The answers may bring hope to a species that until recently seemed headed for extinction. Denizens of swamps and ox-bow lakes, greater one-horned rhinos once

splashed across the vast floodplains of all of South Asia's great rivers: the Ganges, the Indus and the Brahmaputra. Early explorers often spotted the odd-looking ungulate with a single horn, and their accounts may have fueled the unicorn myth in medieval Europe. But the ponderous, mud-covered rhino clearly hails from an earthier stable than the delicate unicorn: large bulls may be 6 feet tall, as long as 13 feet from head to tip of tail, and weigh more than 4,400 pounds. Huge skin folds create the illusion of armor plating, and skin bumps resemble rivets, accounting for references to rhinos as living tanks.

The same awe that the creature inspires in people helped fuel the rhino's destruction. Local myths hold that the animals

In lush grasslands of Nepal's Chitwan National Park (left), a female and her calf graze in protected habitat. Young rhinos stay with their mothers for about four years—until a new calf is born.

Two bulls battle for possession of a wallow (below) in a fight which leads to creation of a dominance hierarchy and access to breeding females. Turnovers in the hierarchy promote genetic mixing.



are immortal, and that their single 9- to 14-inch-long horns possess magical healing and aphrodisiacal powers. As a result, thousands of greater one-horned rhinos have been slaughtered in this century for their horns. The same preoccupation with the horns of the four other species of rhinos (the black rhinoceros and white rhinoceros of Africa, the Sumatran rhinoceros and the Javan rhinoceros) has caused a crash in their numbers. At the same time, extensive habitat destruction continues to threaten wild populations of Javan, Sumatran and greater one-horned rhinos.

Despite these threats, the greater one-horned rhinoceros has managed to survive in the remote jungles of Nepal and India, in an area known as the Terai, an extension of the Gangetic Plain. But when we began our work in Chitwan, where a small percentage of the total population of about 1,200 to 1,500 rhinos live, no one knew exactly how many animals were there nor how they were doing; the rhinos had not been counted in a decade. So we devoted the first two years of field work to estimating their numbers.

Because radio-collaring all of the animals was not feasible, we relied upon distinct combinations of body markings that permitted us to identify each rhino. Most individuals sport large bumps and wrinkles along the main skin folds. Others dis-

play grooved, chipped or broken horns. Still other adults flaunt the legacy of combat and courtship, including cuts on the ears, clipped tails and body scars. Once we took photographs of these distinguishing features and assembled them in the rhino equivalent of a high school yearbook, field identifications became quick and unambiguous.

Collecting the information we needed, however, was not always easy. Sexing immature rhinos, for example, required patience. The best method was watching an unknown individual long enough to catch it in the act of urinating. Males typically squirt urine from low under their bodies, females from higher up.

Waiting patiently for an animal to urinate may seem like a thankless task, but it was economically rewarding for our elephant drivers. The reason: rhino urine is an important ingredient of folk medicine, and it fetched handsome prices in the local bazaar. So once a rhino had passed water, often up to several liters in an adult female, the drivers would rush to mop up the pungent liquid.

Our census revealed a total of 375 to 400 rhinoceros for the park and adjacent forests. By our calculations, this meant that the Chitwan population has increased about 55 percent since 1975.

After counting this population, we be-

MASASHIRO IJUMA (2); PAGES 4-5, MASASHIRO IJUMA

gan to radio-collar individual animals in order to better understand rhino breeding biology. But our first experience immobilizing a male for radio-collaring, ironically, nearly proved to be our last. A dominant male dubbed Yadav refused to drop after being hit with a dose that was supposed to sedate any rhino. A second tranquilizer dart put Yadav down, but he still took longer than we expected to become unconscious.

Extremely nervous on our first date with an immobilized rhino, we measured and radio-collared Yadav with fluttering hearts and sweaty palms. The anxiety was justified.

## What can be learned about rhino society from studying more than 50 darted giants?

When we were still performing our last task, Yadav suddenly rose to his feet, sending our team running for tree limbs, vines and elephant trunks to climb out of harm's way. Premature arousal of supposedly drugged rhinos somehow hadn't been

mentioned in our darting textbook. Fortunately, no one was hurt and Yadav proved to be an exception; none of the 50-odd immobilizations that we went on to perform held any similar surprises.

Because we immobilized a host of males, from young toughs to heavyweight contenders to retired champions, we were able to determine the physical traits common to dominant breeding bulls. Two measurements clearly emerged as important. One, not surprisingly, was size. Increased body length, chest girth and neck size typically place breeding bulls in a class by themselves. The added bulk may be important both for threat displays and for delivering and absorbing blows from competitors during fights for dominance.

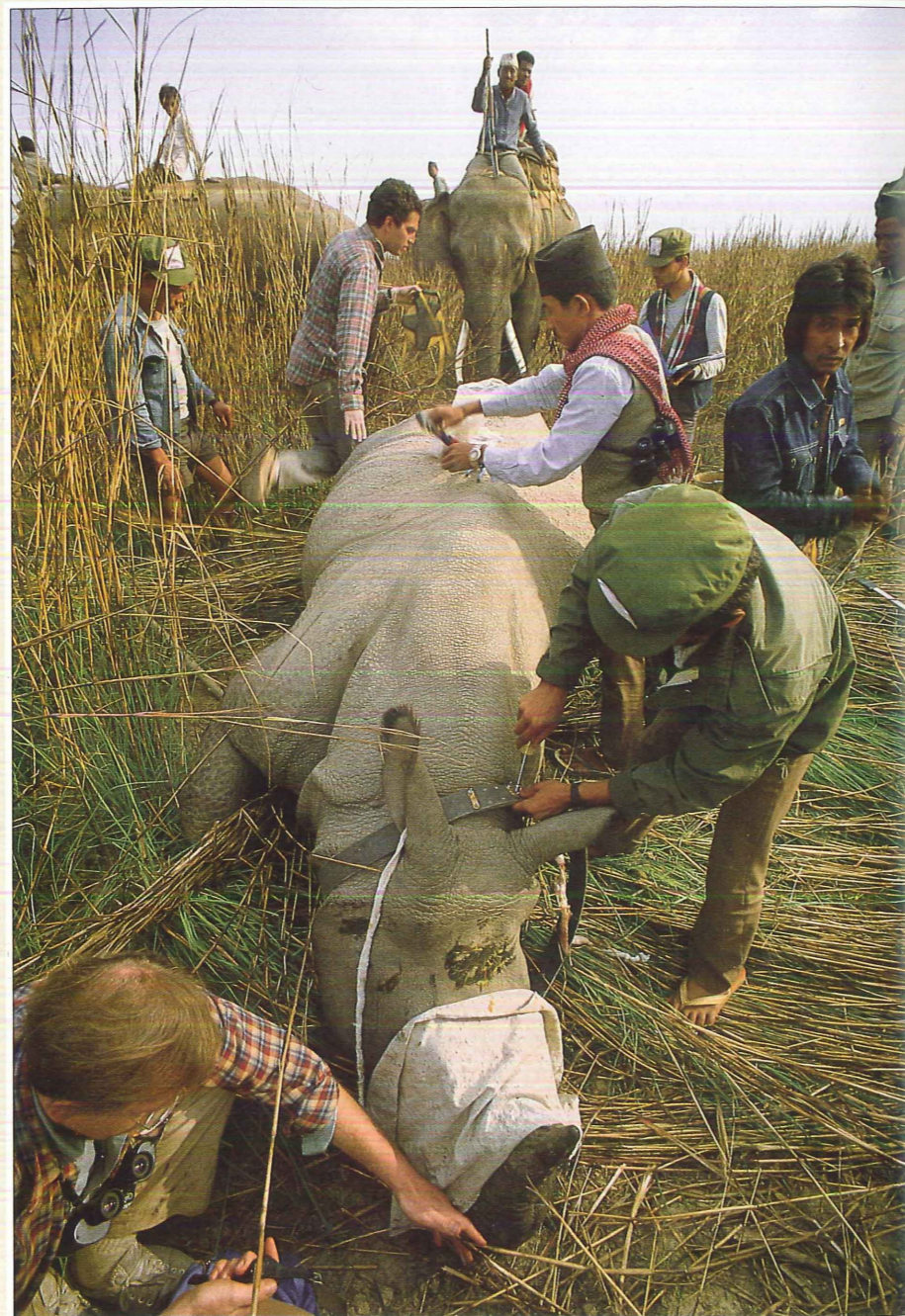
The other key measurement was the length of the lower incisors. Dominant bulls, it turned out, sport razor-sharp tusks up to 3.5 inches long, whereas those of nonbreeding adults measure 0.8 to 2.4 inches.

Certainly one of the most interesting findings of our study was just how vital intact tusks are to rhino males. During a period of only four years, for example, six different bulls won, then lost, control of a particularly lush area of jungle where breeding females cluster. Each was vanquished when one or both of his tusks were broken. Incisors do grow back, but a massive bull with only midget tusks is no match for even a smaller breeder equipped with longer dental weaponry.



CAROL LORRAINE PRICE

Understanding rhino behavior begins with up-close exams of individuals in the wild. To immobilize a rhino (right), researchers on elephantback sedate the giant creature with darts. Once a rhino goes down (below), workers affix a radio collar so the animal can be followed later. More than 25 measurements are taken, and blood is drawn for genetic comparisons. Dental checks of males (left) help in understanding social organization: large, unbroken incisors enable a bull to maintain dominance.



WILLIAM THOMPSON (2)





ERIC DINERSTEIN

We were lucky enough to witness some of the rhinos' pitched battles for dominance. Once the drama nearly entered our dining room. We were en route to the dining hall from the kitchen of our camp one sultry monsoon evening when—out of nowhere—one powerful bull chased another across our path, both galloping at full tilt. Pots shook and pans rattled. The two interlopers plowed right through the barbed-wire fence enclosing our camp as if it were nothing more than a party ribbon.

The loser in this turf war, Karne (M008), suffered serious gashes, along with two broken tusks. He also lost his old home range—the best rhino habitat in the park, rich in nutritious grasses and breeding females. For months he lived in celibate exile near our camp, avoiding confrontations with Conan (M038), the bull that had usurped him. A year later Conan, too, fell, deposed by Cut Ear.

Meanwhile, Karne recovered his strength but not his once-prodigious incisors. Returning to his old home range, he suffered grave wounds in a fight with Cut Ear and died soon thereafter, probably from infection.

Our study offered more than just un-

**Elephants (above) are ideal vehicles for tracking subjects which rest or feed in tall grass. New insights into the behavior and genetics of rhinos like Cut Ear (right) enable scientists to devise strategies for conserving the species.**

ending drama, however. It also provided key insights into rhino conservation. With many rare animals, a small population size can lead to inbreeding and a loss of genetic variability. Not so with the Chitwan rhinos. The rapid turnover we discovered at the top of the rhino dominance hierarchy means that fathers probably never have the opportunity to breed with their daughters. Young males are driven from their mothers when the female gives birth to her next calf. Dominant bulls pose mortal threats to subadult males, so they rarely remain close to their birthplace and their mothers.

The results of our lab tests were startling. Levels of genetic variation in the Chitwan rhino population, it turns out, approach the highest recorded for wild mammals. For other now-endangered large mammals, which, like rhinos, remained abundant until relatively recently

and have long generation times, this finding spells hope. It means that Earth's charismatic megafauna may have lost only small amounts of genetic diversity.

Another implication of our work offered even more hope for rhino conservation. Big mammals tend to wander across a wide landscape. Greater one-horned rhinos, however, living on the lush flood plains of the Subcontinent, occupy home ranges as small as three-quarters of a square mile. This means that many rhinos can be packed into a very small area. Because some riverine grasslands remain underutilized by rhinos (the result of heavy poaching during the 1950s), the population should continue to expand as rhinos recolonize former haunts. Even as the Chitwan population rebounds, it has already become a source for restocking other protected reserves where rhinoceros once ruled as king of the marshlands. ▣

*Eric Dinerstein is a biologist with the Smithsonian Institution and the World Wildlife Fund, which, along with the U.S. Agency for International Development, funded his work in Nepal. He is active in rhino conservation throughout Asia.*

MASAHITO UJIMA

