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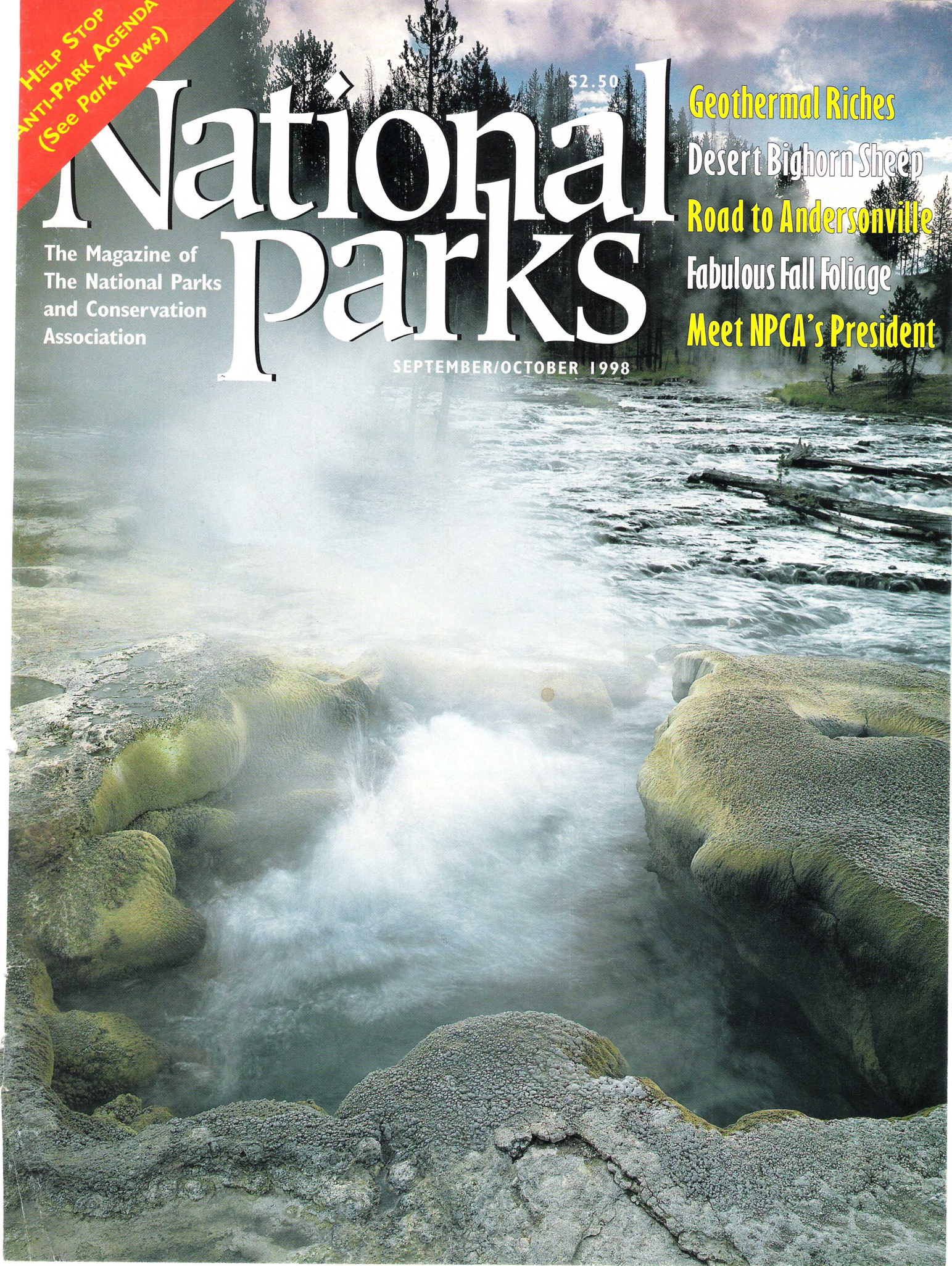
**Geothermal Riches**

**Desert Bighorn Sheep**

**Road to Andersonville**

**Fabulous Fall Foliage**

**Meet NPCA's President**





ticks that carry infecting organisms from livestock. The diseases are usually fatal. "Although die-offs do not occur at every exposure, the near proximity to domestic sheep is considered a high-risk situation," says Singer. The wild sheep that do survive may become carriers and spread the disease to other herds.

Among the most ubiquitous of bighorn diseases is *Pasteurella pneumoniae*. Biologists suspect *Pasteurella* may have been responsible for depleting the North San Juan herd that ranges into the Needles district of Canyonlands, though Craig Hauke, natural resource specialist at the park, says the exact cause has been hard to prove.

Whatever the cause, the decline has been dramatic. "The North San Juan herd is nearly nonexistent," says biologist Karpowitz. "They've pretty much disappeared." He counted only six sheep in the herd during a 1996 aerial survey, whereas in the mid-1970s, biologists had counted 250. "We were finding dead sheep along the Colorado River and saw live ones coughing—a symptom of pneumonia," says Karpowitz.

Like American Indian tribes reeling from European smallpox infections, desert bighorns are slowly rebounding from such microscopic invaders. The Lockhart Basin herd, a subgroup of the San Juan population, occupies cliffs just north of Canyonlands. "They've recovered quite well," says Karpowitz, who counted 53 animals in 1996. "We think the Lockhart bighorns were affected by the same disease that wiped out the North San Juan herd and are now making a comeback."

Desert bighorns dying from diseases may soon get help from a new *Pasteurella* vaccine developed by wildlife veterinarian Michael Miller with the Colorado Division of Wildlife. "This is the first vaccine that has worked on bighorns. It's very safe and stimulates a good antibody response," says Miller. In experimental trials, the shot reduced mortality by 60 percent in wild sheep exposed to *Pasteurella*, and field tests began in February 1998.

To help prevent the spread of disease and reduce competition for resources,



**As more and more people are moving to and recreating in the desert, bighorn sheep become more susceptible to losses from highway collisions.**

domestic sheep and cattle grazing was slowly phased out of Canyonlands National Park by the early 1960s, and the desert bighorn population soared. By law, grazing is still allowed in some areas of Capitol Reef National Park and in Glen Canyon National Recreation Area, however, and officials say they would like to see grazing end in those units as well. Because bighorn die-offs in Park Service units can occur anytime they come in contact with domestic livestock, "the best situation would be to have no livestock grazing anywhere in bighorn habitat," said Hauke.

Increasing human activity and development in wild sheep habitat may necessitate more intensive management along with other conservation measures if remaining herds are to survive. This year, the federal government added 280 Peninsular bighorns living near rapidly growing areas in California's southern desert to the endangered species list. At this point, it's anyone's guess how this designation will affect the management of other bighorn populations, says Singer. But one thing is certain: "More and more people are moving to and recreating in the deserts, and the subse-

quent development is having a negative impact on wild sheep."

Desert bighorns living in Lockhart Basin on the edge of Canyonlands could soon face similar pressures. As this article went to press, the Salt Lake City-based Southern Utah Wilderness Alliance (SUWA) had filed an appeal to stop an exploratory oil well in the basin. SUWA representatives say the Bureau of Land Management should reverse its approval of the well mainly because it would be located within critical bighorn habitat.

With the multitude of management issues involved, some biologists are now expressing their concern with over-handling bighorns. "The biological and aesthetic or moral costs of any degree of domestication can no longer be ignored," writes Paul R. Krausman in *Counting Sheep: 20 Ways of Seeing Desert Bighorn*, edited by Gary Paul Nabhan. A professor of wildlife at the University of Arizona, Krausman says, "If people continue to diminish the habitat

available to mountain sheep, intensive, livestock-style management will become inevitable." In the same anthology, biologist Harley G. Shaw writes, "I worry the helicopter, the dart, and the net may have already begun the process. Sheep are now too easy to catch."

While management activities such as capturing and flying wild bighorns to their former range are necessary and in fact commendable, park biologists and resource managers must decide when too much tinkering threatens the very wildness of the animals. And it's up to society—you and me—to make sure desert sheep and other free-roaming native ungulates will always have vast, wild places to live, inside park boundaries and beyond. In the words of natural history writer David E. Brown, "The bighorn sheep remains the ultimate symbol of the desert's wildness and our longing for identity with it. To those of us who love the desert, the sheep are us and we are them."

DAVID N.B. LEE specializes in environmental and travel writing. He last wrote for National Parks about kayaking in the parks.



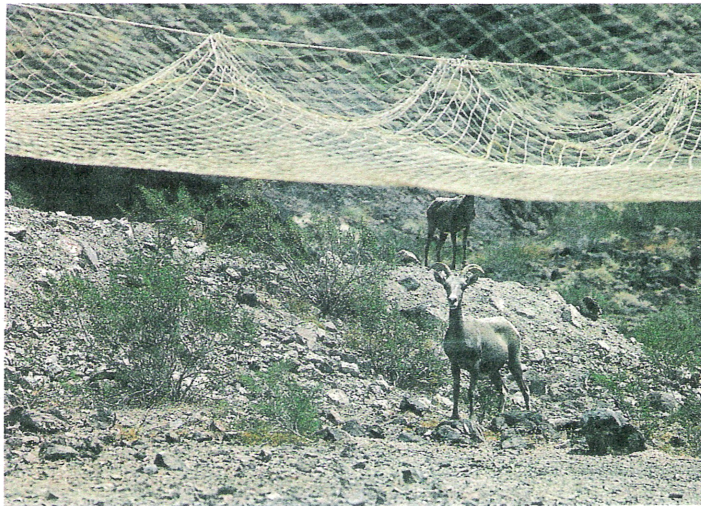
federal biologists began importing, or "translocating," bighorns from established herds in Canyonlands National Park and other areas to found several new herds. "Bighorns are notoriously poor dispersers," says Singer, "so translocations are often the only way to get them back to their historic range."

In 1991, the National Park Service (NPS) and other government agencies launched a major translocation campaign in Utah, Colorado, Wyoming, Montana, and the Dakotas. "The scale, time, effort, cost, and complexity of this approach are, with few exceptions, unprecedented in the history of wildlife restoration efforts in North America," says Singer, who was the initiative's leader.

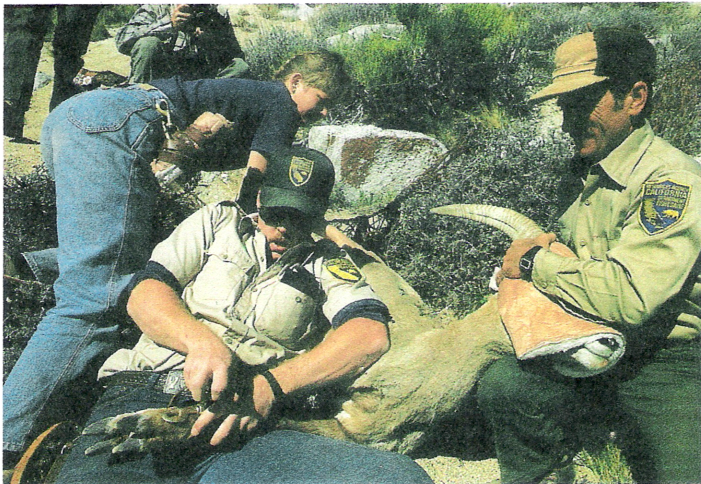
The goal of the six-year program was to recolonize bighorn habitat in and around more than a dozen park units, explains Singer, eventually rebuilding the original, interconnected "metapopulation." Before the move, biologists surveyed 15 park units for existing bighorns and used geographic information systems (GIS) to identify unoccupied yet suitable habitat. With this information, wild sheep specialists made recommendations to interagency committees, which decided where and how translocations would be carried out.

Between 1994 and 1996, restoration teams used helicopters and net guns to capture and move more than 100 desert bighorns from Canyonlands and other areas into unoccupied habitat in Capitol Reef National Park and Glen Canyon National Recreation Area. Reintroduction also occurred in Badlands National Park in South Dakota, Theodore Roosevelt National Park in North Dakota, and Bighorn Canyon National Recreation Area in Wyoming.

BOB HICKER/TON STACK & ASSOCIATES



GALEN ROWELL



**In 1991, NPS launched a program to recolonize bighorn sheep in habitat in and around more than a dozen parks. Scientists used nets and helicopters to capture and move more than 100 bighorns from Canyonlands.**

According to Singer, this effort succeeded by "combining GIS and on-the-ground habitat assessments, careful planning, conservation biology theory, and interagency cooperation." He also attributes the initiative's good results to "vigorously avoiding" areas where domestic sheep graze and gaining the input of each park unit and all nearby agencies in the planning process.

Future restoration plans call for moving another 20 to 30 bighorns to Capitol Reef and at least 140 to Glen Canyon, but managers estimate it will take about \$100,000 to complete the process. With government funding uncertain, the program depends on securing federal budget allocations and grants from such corporations as Canon U.S.A., Inc. Although a research biolo-

gist, Singer and NPS bighorn program coordinator Michelle Gudorf have by necessity become fundraisers, putting in a lot of effort chasing fewer and fewer dollars.

Although bighorn populations in many park units are far better off than they were even 10 years ago, wild sheep still have a long way to go before they are out of danger. Despite the Herculean restoration effort, only nine out of 34 bighorn populations (27 percent) in Park Service units from Utah to North Dakota are considered moderately secure for long-term survival. In Arches, Canyonlands, and Capitol Reef national parks, bighorns live in only a third of their suitable habitat. In Glen Canyon National Recreation Area, they occupy 14 percent of their available range.

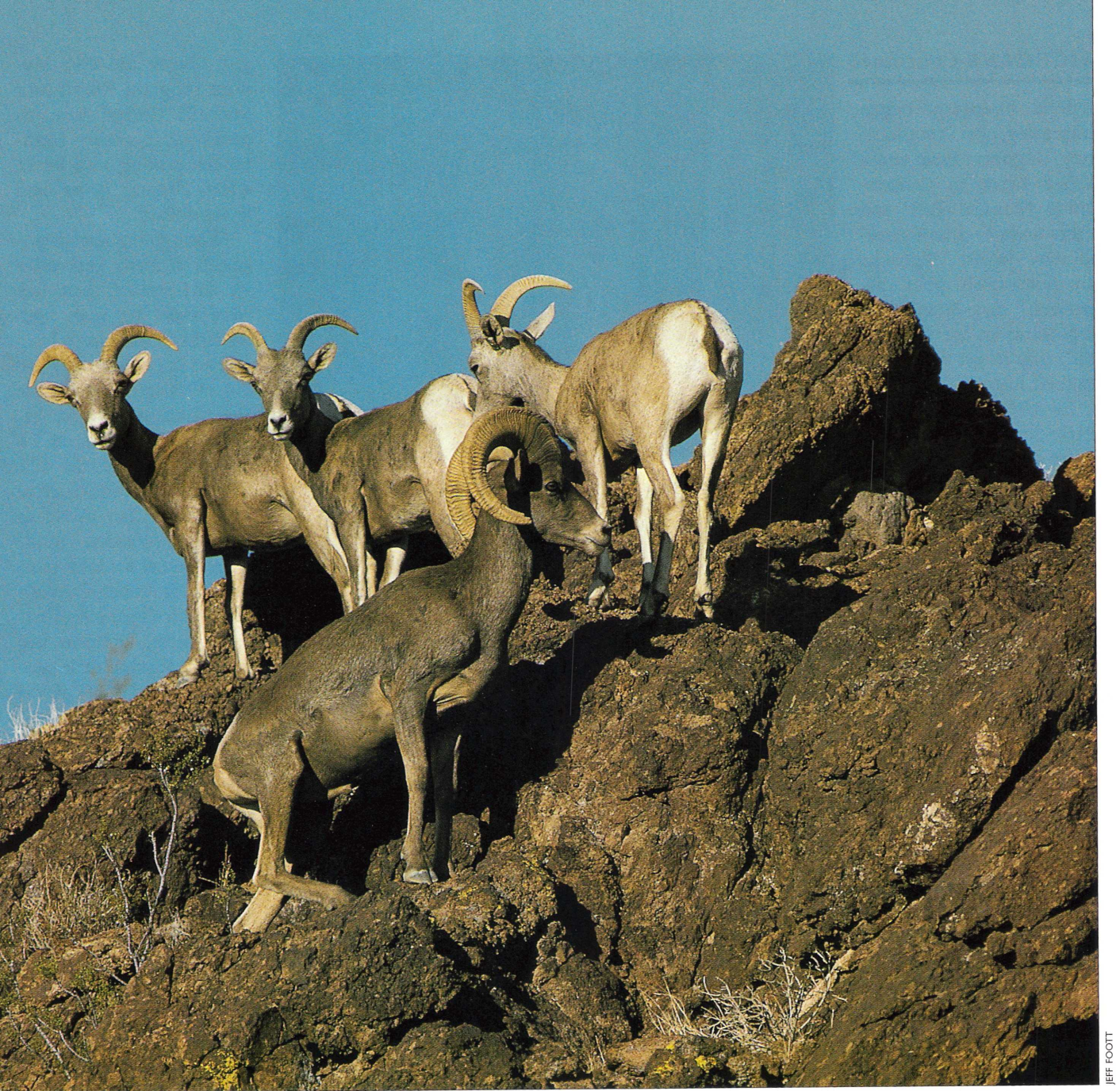
"Translocated bighorns tend to be sedentary," explains Singer, "a fact which impedes their discovery of new habitat and increases the risks of disease transmission and predation." Gene flow is also reduced when rams don't move be-

tween herds.

In fact, all bighorn races are susceptible to a variety of diseases, partly because the same network of air pockets, or sinuses, that makes their horns lightweight also acts as a reservoir for infection. The list reads like a public health official's worst nightmare: epizootic hemorrhagic disease and bluetongue (viruses that cause bleeding disorders), moraxella (the bacteria that cause pink-eye and pneumonia), bovine sinusoidal respiratory virus, anaplasmosis (a malaria-like disease), and psoroptic scabies, which infects the skin and ears to such a point it can render bighorns deaf—or dead.

Bighorns contract most of these afflictions by nose-to-nose contact with domestic sheep or through insects and





JEFF FOOT

sources. Later, the building of towns, roads, fences, dams, and canals fragmented the bighorn habitat and created barriers to their movement. These factors combined to virtually eliminate wild sheep from most of their historic range in Utah and throughout the Southwest.

Today, some 60,000 desert bighorns occupy only a third of their original range. They are “habitat specialists,” says Singer, preferring steep, rocky terrain with open visibility and little or no snow in winter. “While there are some large, restored populations, most desert

bighorns now live in small islands of habitat surrounded by flat terrain, forested areas, and human development—all of which they avoid.” Cut off from other groups, bighorn herds are in danger of inbreeding, which can cause a diminished ability to adapt to diseases and changing environmental conditions.

Disease transmission and grazing competition from domestic livestock are still a worry, and many bighorn herds suffer losses from highway collisions and predation from mountain lions, coyotes, and golden eagles. Less

**Before European settlement, bighorns lived throughout the Southwest. Now they occupy a third of that range.**

acute threats include loss of grazing lands to encroaching pinion-juniper forests and sagebrush, often the result of fire-suppression policies, along with development activities in critical habitat.

To counter these threats, Park Service biologists have devoted significant effort to returning desert bighorns to their historic ranges or remaining suitable habitat. Starting as early as 1946, but especially in the 1980s, state and



# BACK where they BELONG

An ambitious Park Service program seeks to return desert bighorn to their historic range in more than a dozen parks. Unlike their Rocky Mountain cousins, this subspecies has adapted to hot, dry conditions.

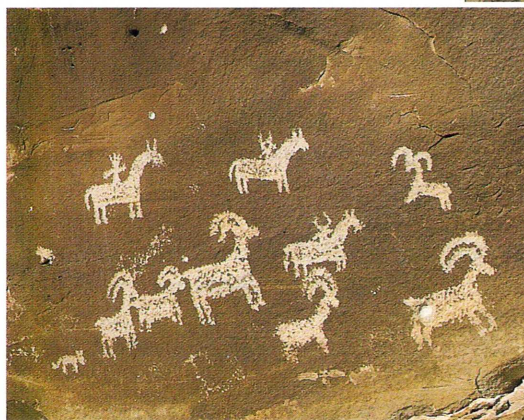
BY DAVID N. B. LEE

ON A GLORIOUS spring day in Canyonlands National Park in Utah, volunteer ranger Keni Koreba had a close encounter of the wild kind. "I was sitting on a rock outcrop," she recalls, "when a bighorn ram suddenly appeared about 20 feet away." After her initial shock, Koreba said she was comforted by the presence of the huge animal. "It would have somehow been more lonely and cold without him there," she mused.

Like Koreba, more and more national park visitors are seeing desert bighorn sheep, thanks to a comprehensive reintroduction effort under way in half a dozen Western park units. A key focus of the program, Canyonlands has served as a vital source of individual sheep and of genetic variation for restoration efforts.

"Canyonlands is unique in that it holds one of the few remaining native populations of desert bighorns. If we had not developed other herds through transplants, this would have been the only herd in the state," says Utah Division of Wildlife Resources biologist Jim Karpowicz. "It's all part of getting bighorns back where they belong."

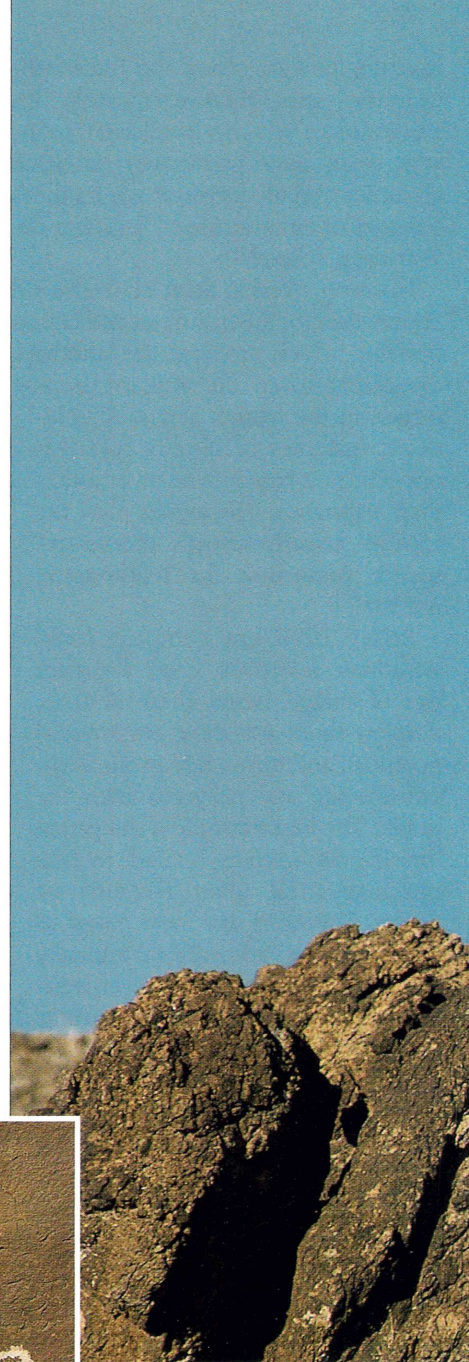
Although taxonomic changes are under consideration, desert or Nelson's bighorns (*Ovis canadensis nelsoni*) are considered by most biologists to be a separate subspecies. Unlike their Rocky Mountain cousins, desert bighorns have



KIM TODD

adapted to life in a hot, dry environment. Compared with other subspecies, desert sheep are small, have a light coat, long legs, and wide horns.

Before European settlement, desert bighorns occupied rocky cliffs throughout the Southwest. Desert sheep are quite common in ancient Anasazi and Fremont Indian pictographs, a sign of the animals' physical presence and their



prominence in the minds of indigenous peoples.

But bighorn populations experienced "catastrophic declines" starting in the mid-1800s, says Francis Singer, a research ecologist with the Biological Resources Division of the U.S. Geological Survey in Fort Collins, Colorado. As settlers and miners moved in, they hunted wild sheep for food and profit. Diseases transmitted from domestic livestock took a major toll as cattle, domestic sheep, and feral burros competed with bighorns for grazing areas and water