The Saola's Last Stand
Author(s): Richard Stone
Source: *Science*, New Series, Vol. 314, No. 5804 (Dec. 1, 2006), pp. 1380-1381, 1383
Published by: American Association for the Advancement of Science
Stable URL: https://www.jstor.org/stable/20032910
Accessed: 14-04-2019 06:18 UTC

Vanishing breed. A young captive saola shortly before its death in Hanoi in 1993.

WILDLIFE CONSERVATION

The Saola's Last Stand

Wildlife experts say the rare Southeast Asian ungulate may soon disappear; a Vietnamese lab is undertaking a controversial attempt to clone it

PU MAT NATURE RESERVE, VIETNAM—Do Tuoc climbs a steep riverbank, entering the realm of the elusive saola. The creature, a cousin of cows, goats, and antelopes, is so rare that even Tuoc, who discovered the species in 1992, has never spied one in the wild. The forest ecologist finds safe footing on the slick slope and grabs a handful of broad, dark-green Araceae leaves. "Saola like to eat these," Tuoc says. "At least, we have seen bite marks."

A decade ago, the saola made headlines as the first large mammal new to science in more than half a century. Recent sleuthing suggests that the exotic ungulate is sliding toward extinction. At most, 250 saola are thought to roam the Annamites (called the Truong Son Mountains in Vietnam) of central Vietnam and Laos.

Now scientists are embarking on a last-ditch effort to save the critically endangered species. Vietnam's National Saola Conservation Action Plan, expected to be approved by the government later this month, prescribes measures, including a hunting ban, that are deemed essential for the saola's survival. Meanwhile, a Vietnamese team is pursuing a conservation option of last resort: an attempt to clone the saola. But somatic cloning is supremely difficult even in the best-studied mammals—and "we know almost nothing about the saola," says zoologist Nguyen Xuan Dang of the Institute of Ecology and Biological Resources in Hanoi.

More is at stake than one obscure relict species. The ecosystem that shelters the saola is home to an array of creatures, including at least two kinds of muntjac deer found nowhere else in the world. Saving this unique menagerie "would be a success story for other countries to follow," says Barney Long, a conservation biologist with the World Wide Fund for Nature (WWF) who is working with local scientists and officials to protect the saola in central Vietnam.

On the track of unknown animals. Ecologist Do Tuoc, Araceae in hand, at the Pu Mat Nature Reserve.

The odds are against Long and company. "Foundations can easily raise funds for primates, tigers, elephants, rhinos," says Dang. "For the saola, we can't even get money to educate the public, to tell people to stop hunting it." As Vietnam's action plan notes starkly, "resources and attention afforded to the saola are currently insufficient to protect it from extinction in the immediate future."

Trophy hunting

Whereas biologists are captivated by the saola's unicornlike mystique, villagers in Truong Huong, on the edge of the Pu Mat Nature Reserve, are blasé about the beast. Few in this ethnic Thai community have seen a saola, and when they do, the outcome for the demure herbivore is almost invariably bad.

In a wooden house built on stilts, Lo Van Tinh, a farmer, sits cross-legged with four generations of family huddled around him and describes how, one day 10 years ago, he was hunting turtles in a mountain river. His dog spotted a saola mother and calf upstream and gave chase. The mother escaped, but her calf was cornered and assumed a defensive posture. Although a saola in captivity betrays no fear of humans, at the sight of a dog it snorts and hunkers head down, brandishing its long, straight horns, says saola expert William Robichaud, a zoologist with the Nakai-Nam Theun National Protected Area in Laos. That renders the saola easy to shoot, and for a juvenile, easy to grab. "I caught it with my hands," says Tinh. The saola did not survive the 2-day hike back to Truong Huong, so Tinh and his family ate it. It was like beef, although not as tasty, he says.

In a home in nearby Truong Chinh village, a pair of saola horns hangs in a place of honor next to a poster of a smiling Vietnamese model. The dark-brown horns, about 40 centimeters in length, are more than twice as long as the head, which has short, coarse, chestnut-brown hair. To local people, the slightly diverging horns resemble the parallel wooden posts that support a spinning wheel (hence the name: *Sao* means "post," and *la* means "spinning wheel"). Streaks of white hair above the eyes look like garish mascara.

It was in a home just like this that Tuoc discovered the saola. In May 1992, he was part of a team dispatched by the Ministry of Forestry, with WWF support, to Vu Quang forest, roughly 100 kilometers southeast of Pu Mat, to survey biodiversity in advance of Vu Quang's designation as a nature reserve.

CREDITS (TOP TO BOTTOM): WWF-CANON/DAVID HULSE; MUTSUMI STONE

Tuoc, schmoozing with the local villagers, wangled an invitation to a young hunter's home, where the team was shown a peculiar skull and horns. "I immediately thought it was a new species of antelope," Tuoc says. But it was puzzling, as antelope prefer dry areas, and much of the Truong Son range is soaked by seasonal monsoons. Excited by the find, he asked local hunters to look for other specimens. Two more pairs of horns soon materialized, convincing the scientists that they had indeed found a new species, which they anointed the "Vu Quang ox."

WWF funded a follow-up survey that November that turned up about two dozen pairs of horns and an intact saola skin. DNA analysis of the mitochondrial cytochrome b gene revealed a new bovid genus, and a paper in *Nature* in 1993 unveiled *Pseudoryx nghetinhensis*. (Subsequent DNA analyses suggest that cattle are its closest cousins.) The animal was confirmed in Laos through villager sightings and trophy horns in 1993. The species name is an amalgamation of the two Vietnamese provinces where specimens were first uncovered. The common name Vu Quang ox soon gave way to saola, a less parochial designation and one with historical roots. The first known written reference to the species is in an early 20th century Lao-French dictionary, which defines saola as an "antelope of the rocks," says Robichaud.

The saola was the first large mammal discovery since the kouprey, a wild ox in Southeast Asia, in 1937. As an encore, Tuoc and colleagues first described the large-antlered (formerly giant) muntjac in 1994 and the diminutive Truong Son muntjac in 1997. (Both were discovered simultaneously in Laos.) With three mammal species under his belt, Tuoc has become a legend in cryptozoology, the study of previously unknown, presumed, or mythical creatures. "I've been very lucky," he says.

Zoological riddle

Ever since the saola's appearance, its biology, like the animal itself, has remained an enigma. In June 1993, Tuoc and colleagues at the Forest Inventory and Planning Institute in Hanoi took custody of two young saola that had been captured in Vu Quang. The animals ate several dozen kinds of plants and put on weight fast, Tuoc says. But after 2 months, they succumbed to infections. In all, 20-odd saola have been captured in Vietnam and Laos. All but two that were released into the wild died quickly in captivity.

The saola's fragility is no big surprise. "Certain animals in captivity, especially ungulates, are highly sensitive to stress," says David Wildt, head of the Center for Species Survival at the Smithsonian's Conservation and Research Center near Front Royal, Virginia. Or the problem could be as simple as an "inappropriate" diet, says Wildt, whose team has pioneered techniques for breeding delicate creatures such as the Elds deer and the black-footed ferret. "A careful examination of why these animals die after capture is really needed," he says.

What little is known about the saola has been gleaned primarily from the short-lived captives. In the mid-1990s, Cheng Syavong, a Lao general, offered a reward for the capture of a saola for his Lak Xao Zoo. In January 1996, Cheng procured an adult female. "I had the good fortune to observe her daily," says Robichaud. The saola, he says, marked territory by flaring open a fleshy flap covering her maxillary glands on either side of the snout and stroking the underside across rocks, depositing a pungent, musky paste. The massive scent glands are thought to be the largest of any living mammal.

Museum piece. A saola head in a hunter's home near Pu Mat. Saola sightings in Laos and Vietnam are dwindling.

"Her most striking and endearing aspect," Robichaud says, "was her utter calmness in the presence of humans." Soon after arriving at Lak Xao, the saola allowed people to stroke her and fed from their hands. "She was tamer and more approachable than any domestic livestock I'd ever been around," he says. But after a mere 18 days in captivity, the saola died suddenly, and no autopsy was performed—although she was found to be bearing a male fetus.

Saola are so rarely seen in the wild that it wasn't until 1998 that one was first caught on film in its habitat, by a camera trap near a mineral-rich spring in Pu Mat. Robichaud and Robert Timmons, an independent conservation biologist in Southeast Asia, have suggested that the survivors are descendents of a Pleistocene bottleneck, when their wet evergreen forests receded during cool, dry ice ages. "The current distribution of saola may reflect where these ice age refugia were," says Robichaud.

Humans now have the saola on the ropes. In 1992, scientists pegged the population at 500 to 1000 in Vietnam, says Long. The estimate in Vietnam's action plan—"probably" fewer than 200—could be a large under- or overestimate, he says. But Long says a decline is evident "from the amount of hunted trophies that we see" and the lack of sightings in areas where the saola once roamed. Saola are also killed in snares set for more lucrative game such as bears, which fetch a high price for their gall bladders. Vietnam's action plan would ban snares in saola territory.

Habitat fragmentation further endangers the species. The action plan notes that the

CREDIT (TOP): MUTSUMI STONE

nearly completed Ho Chi Minh Highway, which will link northern and southern Vietnam, "must be viewed as the single largest threat to the connectivity of Saola populations and their habitat." With support from the World Bank, the Dutch Development Organization, and the U.S. Agency for International Development, WWF is working with Vietnamese authorities to protect forests in two provinces, Thua Thien Hue and Quang Nam, where the largest saola subpopulation, approximately 50 individuals, is found. This "Saola Conservation Landscape" abuts forests in Laos, providing contiguous habitat for some of the few dozen saola thought to live across the border.

As an additional safeguard, Vietnam's national action plan would forbid keeping saola in captivity until 2010, unless one is confiscated from a hunter or liberated from a snare and is too injured to be released into the wild. To Wildt, this is a risky strategy. "I don't go along with the philosophy of leave them only in the wild and hope for the best," he says. He suggests that saola experts convene a workshop that would take a hard look at captive breeding. "It's not like this has never been done before," he says.

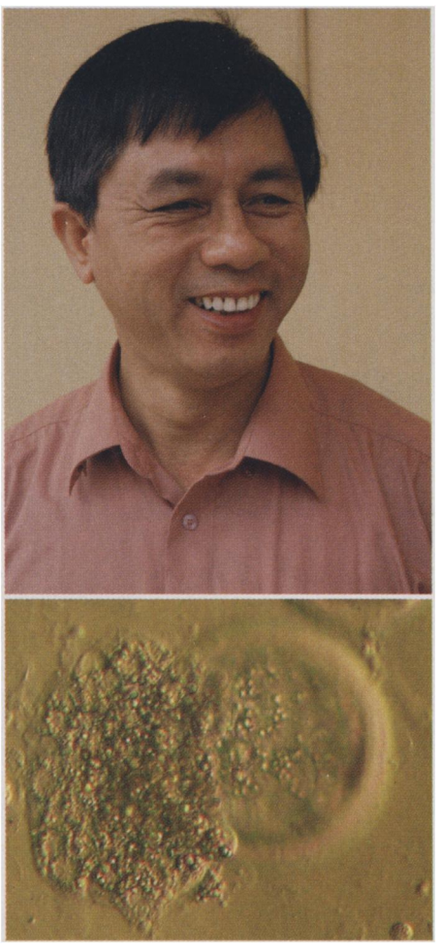
A genetic "Hail Mary"

Long and others argue that without a robust effort to shield the saola from hunters and preserve its habitat, the animal is doomed. For all they know, the species may already have passed the point of no return.

That possibility is the main justification for a controversial, high-tech bid to keep the species on life support. On the tree-lined grounds of the Vietnamese Academy of Science and Technology in central Hanoi, a team at the Institute of Biotechnology led by Bui Xuan Nguyen is trying to clone the saola.

Nguyen knows the project is a long shot. But his lab has a chance at succeeding: He and his staff have been collaborating with top reproductive biologists in France, Japan, and elsewhere for 30 years and have racked up achievements in embryo transfer and in vitro fertilization in animals such as cows and rabbits. Nguyen is also credited with having developed a technique for rapidly freezing eggs and sperm that is particularly handy for preserving samples in the field. Building on this work, Nguyen is spearheading an effort to set up a lab network in Southeast Asia next year to "cryobank" frozen germ cells of rare species.

Soon after the cloning of the sheep Dolly in 1997, Nguyen says, he thought the revolutionary technique might be applicable to endangered species conservation. By then, the saola had become an icon in Vietnam. Nguyen struck up a collaboration with Tuoc's forest institute. "When someone finds a saola, the institute calls us and we immediately go take tissue samples," Nguyen says. They have samples from one male and two females, including 30 immature eggs from one of the females that died.



Eleventh-hour heroics? Bui Xuan Nguyen hopes to clone a saola. So far, his team's early saola embryos have failed to develop.

They've held on to most of the eggs in the event that, someday, they might be able to attempt in vitro fertilization. But Nguyen has decided that "we cannot wait for a live female." Working with Patrick Chesné from the lab of Jean-Paul Renard of the National Institute for Agricultural Research in Paris, Nguyen has used nuclear transfer to inject saola DNA into cow, goat, and swamp buffalo eggs. They have obtained early embryos—blastocysts—but these fail to develop. "We don't have any idea how to get past this stage," Nguyen says. A fundamental hurdle is the dearth of knowledge about saola biology. "We have no information on the reproductive cycle, no idea how long pregnancy lasts," he says.

Nguyen and his collaborators have filled in some gaps. For instance, they've established that the saola has 50 chromosomes. (Cows have 60, buffalo 84.) Nguyen now hopes to unravel how saola nuclei are reprogrammed. During reprogramming, an egg turns back the clock on an adult nucleus by removing chemical signatures of development, which returns it to an embryonic state—an essential step in somatic cloning. "We're interested in early molecular events in saola and closely related species," says Renard.

When all the problems of interspecies cloning—such as different chromosome numbers and different mitochondrial DNA—are solved, then "cloning the saola will be possible," predicts Takashi Nagai, a reproductive biologist at the National Institute of Livestock and Grassland Science in Tsukuba, Japan, who is working with Nguyen to conserve the genetic line of Vietnamese miniature pigs. Nguyen says he will persevere: "I'm a patient man."

Some biologists, however, deem the effort hasty—or misguided. "Cloning is a tool for last-ditch heroics," says Wildt. "It's too premature to consider it" for the saola, he says. "I don't see any conservation benefit from cloning the saola," adds Long. "The money ... would be much better spent trying to protect the species in the wild." (Nguyen says his funding is "modest.") To Long, the battle must be fought in the Truong Son Mountains. "If we lose the saola," he says, "it will be a symbol of our failure to protect this unique ecosystem."

That could jeopardize unknown species. "In Vietnam, there is still a lot of terrain not yet surveyed," says Dang. Only in 2005, the kha-nyou, a bizarre, smallish rodent, was described from a specimen found in a Lao market; an expedition brought back the first live specimen last May. "There are small and medium-sized animals waiting to be discovered," Dang says.

Optimists about the saola's fate are about as rare as the animal itself—but Tuoc is one of them. Natural enemies like the dhole are becoming scarcer, he says. Provided that snares are removed and vital habitat is preserved, the saola should be able to rebound, Tuoc says. "Maybe I'll never see one in the wild," admits the cryptozoologist extraordinaire. "But I think—no, I hope—it will survive." For the saola, survival will mean vanishing back into the misty sanctuary that hid it so well until humans came along.

–RICHARD STONE

CREDITS (TOP TO BOTTOM): MUTSUMI STONE; BUI XUAN NGUYEN