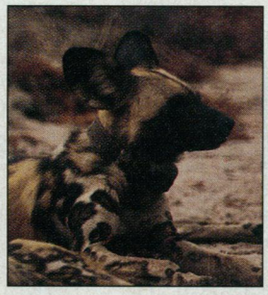
WILDLIFE BIOLOGY

Dogfight Erupts Over Animal Studies in the Serengeti

Five years ago, the last five packs of endangered wild dogs being studied in Tanzania's Serengeti National Park died. Ever since, wildlife biologists have been baying and nipping at each other's heels over who or what was responsible for the dogs' demise. Although the dog population had been steadily declining since the 1960s, some researchers have pointed their fingers at the scientists studying the animals, arguing that handling—with radio collars and darts—so stressed the dogs that they succumbed to latent rabies infections.

The controversial hypothesis, developed by Roger Burrows, a biologist at the University of Exeter in England, has engendered charges and countercharges in several journals since it was first published in 1992. Some researchers also contend that it has had a chilling effect on wildlife research in Tanzania. Permits have been denied or delayed for handling studies of dwarf mongooses and lions, they say, although park authorities insist there is no ban on handling. "It has made life difficult for all of us, and not just in the Serengeti," says Sarah Cleaveland, a veterinarian at London's Institute of Zoology who worked with the Serengeti wild dogs.



PHOTOS BY J. GINSBERG

Handle with care. Did handling—such as placing radio collars on wild dogs such as these, from Zimbabwe—kill animals in the Serengeti?

What's worse, say many scientists, is that the Burrows hypothesis is just plain wrong. "The data are porous and sparse," says Craig Packer, a behavioral ecologist at the University of Minnesota and director of the Serengeti Lion Project, who finds the idea unconvincing. "But if you try to squash it, you end up getting accused of a cover-up." Now, in this month's issue of the *Proceedings of the Royal Society*, several groups attempt to take the hypothesis apart, reporting data that show no mortality differences between handled and unhandled dogs, and that chance events—such as an outbreak of a disease like canine distemper—would more likely have killed the dogs. Separately, rabies experts believe Burrows's ideas about that disease to be unfounded. "I wouldn't even call it a hypothesis; it is more a matter of opinion," says Charles E. Rupprecht, chief of the rabies section at the U.S. Centers for Disease Control and Prevention (CDC) in Atlanta.

Burrows and his co-authors are not backing off. "The hypothesis is compatible with all the Serengeti data ... and has certainly not been tested by those replying to our paper," says Burrows, who responds to the challenges in the *Proceedings*. Few biologists think this exchange will settle the issue. "The problem is," explains Scott Creel, a wildlife biologist at Rockefeller University who studies wild dogs elsewhere in Tanzania, "that no one knows what happened to those packs. No one was monitoring them at the end; and so, for all we know, a meteorite did them in."

Burrows argues that the real catastrophe was scientific intervention. He had taken part in a study of the Serengeti packs from 1989 to 1991 under the auspices of the Frankfurt Zoological Society. During that time, several dogs were radio-collared and, following an outbreak of rabies that apparently killed three of the study packs, most of the dogs in the remaining two packs were darted with a vaccine derived from dead rabies virus. But then a quarrel broke out among the researchers, who split into two groups, and the project broke down. "No one knew what anybody else was doing, but neither group was monitoring the dogs consistently," says one researcher, who prefers to remain anonymous. So by August 1991, between 5 and 10 months after the vaccination program ended, all of the remaining dogs (34) had disappeared, and no one knew what had happened.

Burrows felt there was "possibly a link between radio-collaring and pack mortality." In a letter to *Nature* (24 September 1992, p. 277), he suggested that rabies might have persisted silently in the dogs "in a normal host-parasite relationship with some naturally immune individuals," but elevated stress from handling might make the dogs more susceptible.

Burrows followed this with a longer article in the June 1994 *Proceedings of the Royal Society* (vol. 256, p. 281), and he's continued to elaborate on the idea. In the current issue of the *Proceedings*, he notes that recent experiments "demonstrate that rabies virus can persist for extended periods in macrophages," the immune system's bacteria-killing cells.

And he is not without allies. He has been joined in both *Proceedings* articles by co-authors Heribert Hofer and Marion L. East, wildlife biologists at the Max-Planck Institut fur Verhaltenphysiologie in Seewiesen, Germany. East says they became involved after attending a 1992 workshop on wild dog conservation in Tanzania, which devoted little time to the Serengeti dogs. It seemed to them that the dogs' fate was "just going to be shoved under the table," says East. "I felt that it was a disgrace that the issue was not being dealt with in a straightforward scientific fashion."

Authors in the current *Proceedings* attempt to do exactly that. The idea, says one contributor, Joshua Ginsberg, a zoologist who studied the wild dogs in Zimbabwe's Hwange National Park for 5 years, was to test the hypothesis "piece by piece." The first test—and first point of dispute—is the stress of handling. To determine what adverse effects handling might provoke, Marion S. de Villiers, a zoologist at South Africa's University of Pretoria, and her colleagues compared levels of the stress-related hormone cortisol in 14 captive and 11 free-ranging wild dogs. They immobilized both groups and then measured the hormone levels, reasoning that cortisol levels might be higher in the wild group, which was unused to handling. The scientists found no significant differences.

Ginsberg and his colleagues, in a second article, used a computer simulation of population dynamics that showed that in a small, declining dog population, a chance event alone could have brought about their deaths. In their view, the two most plausible chance events are disease—without any outside trigger—or the Serengeti's thriving populations of lions and hyenas. (Wild dogs fare badly against these larger carnivores.)

A third article also points the finger at a reservoir of domestic dog diseases in the area, such as rabies and canine distemper. Peter Kat, a molecular geneticist at the University of California, Davis, and his colleagues report that they studied wild dogs in Kenya's Masai Mara National Park and concluded that the threat is so serious that "any wild dog that enters the Mara is playing Russian roulette; it's going to die from one of these diseases sooner or later—and you don't need scientists intervening for that to happen."

Separately, rabies specialists dispute Burrows's idea that the wild dogs could carry some kind of "silent" rabies infection for months that was somehow "reactivated" by stress. The research he cites suggesting that rabies lingers in the macrophages is "controversial," says Alexander Wandeler, head of

the rabies unit at the Canadian Animal Disease Research Institute in Nepean, Ontario. It was based on in vitro experiments and may have nothing to do with real animals, he says. Burrows also cites reports that domestic dogs can survive rabies infections and later pass the virus in their saliva, yet those cases are extremely rare, says Makonnen Fekadu, the CDC rabies specialist who actually discovered those cases in Ethiopia. Burrows's "hypothesis contradicts the traditional pathogenesis of rabies," says Wandeler.

Burrows and his colleagues, however, continue to stand by their hypothesis and offer their own statistical arguments to support the idea that intervention increases mortality. Burrows says the cortisol test only examined short-term effects of stress, not long-term consequences. And he regards the notion of canine distemper as a cause of death as only an "opinion."

The unsettled debate has also unsettled studies of wildlife that involve darting and collaring. For example, a 14-year study of the dwarf mongoose came to an end in 1992 when Rosie Woodroffe, a postdoc at Cambridge University, U.K., was denied a permit by Tanzanian park authorities to handle and mark the animals, ostensibly because the study was not specifically oriented toward conservation. Packer has been unable to collect blood samples from Ngorongoro Crater lions even though the animals have dwindled during the last few years from 100 to less than 50. Although park officials deny any connection with the wild dog controversy (and point out that a radio-collared study of zebra and wildebeest is about to get under way), many scientists think otherwise. "I don't think the parks' officials have ever really liked handling," notes Creel, "so let's just say that they're taking a closer look at it now."

Some biologists concede that a closer look at handling is needed, even if Burrows is wrong. "For 30 years, biologists have been acting like cowboys, shooting darts right and left, figuring it had no real impact on the animals," says George Schaller, a conservation biologist with the Wildlife Conservation Society in New York, who has handled everything from lions to pandas. "It's time the subject was addressed experimentally to see how the effects of handling—capturing, radio-collaring, vaccinating, anesthetizing—vary among species."

That type of study is in the works. "We're putting together a compendium of handling on every species," says Packer, although he notes that "overall, I think handling has been unfairly stigmatized." He notes that handling "gives you information to help you better manage the wildlife. As far as the wild dogs go, it would have been better if they'd been handled more. At least then, we'd have the data and could show what actually killed them."

–Virginia Morell

ASTRONOMY

Naked Quasars Get Dressed

With its peerlessly sharp vision, the Hubble Space Telescope (HST) is supposed to clear up cosmic mysteries. Last January, however, when HST took the closest look ever at the enigmatic cosmic beacons called quasars, it added a new puzzle. Quasars, which shine from the far edges of the universe with the brilliance of millions of stars, are widely believed to be black holes fed by gas and stars from large host galaxies. Many of the Hubble images, however, seemed to show "naked" quasars, shining outside any host galaxy. But astronomers who were spurred to rethink their theories of quasars may want to hold off, for it now seems the quasars may not be naked after all.

Even in the Hubble images, made by John Bahcall of the Institute for Advanced Study in Princeton, New Jersey, and his colleagues, the quasars were little more than bright smudges, leaving them open to interpretation. And when Kim McLeod of the Harvard-Smithsonian Center for Astrophysics in Cambridge, Massachusetts, and George Rieke of Steward Observatory at the University of Arizona reanalyzed the same "naked" quasar images, their clothes came into view. Their analysis, which will appear in the 1 December *Astrophysical Journal Letters*, suggests that a bright young host galaxy surrounds every one of the quasars.

"They've made a plausible case," says Donald Schneider of Pennsylvania State University, who works with Bahcall. Bahcall declined to comment on the work, but Schneider says that he and Bahcall differ with some of the assumptions in McLeod and Rieke's analysis. Still, Bahcall's team may end up agreeing with McLeod and Rieke's conclusion, if not their approach: In new Hubble images of some of the same quasars, Schneider now says they, too, may be seeing clear host galaxies.

When Bahcall unveiled the first 15 HST images early this year, researchers expected them to confirm ground-based observations that show faint, fuzzy light around quasars. But in spite of the much higher resolution of the Hubble, Bahcall could see galaxies around only four of the 15 quasars (*Science*, 27 January, p. 456). Some colleagues thought Bahcall simply needed to analyze his data differently, while others went so far as to wonder if the prevailing picture of quasars was wrong.

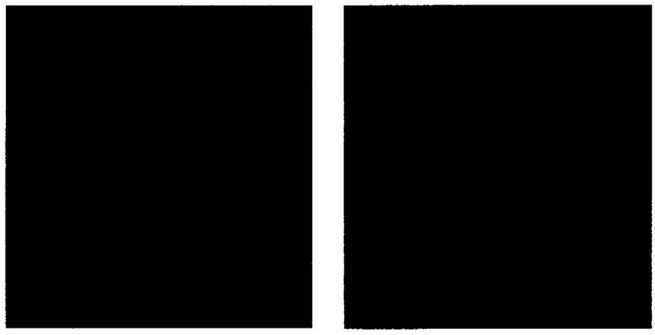
McLeod and Rieke, for their part, wondered if they were mistaken in seeing hints of host galaxies in their own ground-based infrared observations, made while McLeod was a doctoral student at the Steward Observatory. They had found these hints by using a computer to remove the glare of the quasar itself, then fitting various galaxy models to the remaining light. The light profile from "early-type" galaxies, a category that includes elliptical galaxies, worked best. So when Bahcall's group made improved images of the naked quasars, McLeod and Rieke decided to analyze them using the same technique.

To apply the models to the HST smudges, however, they first had to smooth Bahcall's data. McLeod notes that this meant sacrificing the higher resolution of the HST. But she thinks the good fit between the model and the data justifies the procedure. "The results are perfectly consistent with there being bright, early-type galaxies for most of these objects," McLeod says. Agrees quasar expert Robert Williams, director of the Space Telescope Science Institute in Baltimore, "They've come up with something that I think has some validity to it."

Schneider says that while "they have done a careful piece of work," he is cautious about the approach, which assumes a brightness profile and checks its fit instead of simply letting a profile emerge from the residual light. "I'm just a little bit uneasy about doing it that way. You find things that look like what you're looking for," he says.

Even so, Bahcall's team may not be holding out for naked quasars. Schneider says they will present more sensitive HST observations of some of the notorious 11 at the next American Astronomical Society meeting in San Antonio in January that will shed new light on the puzzle. He adds: "I will be surprised if there's a big controversy in 18 months. It'll all be sorted out."

–Jocelyn Kaiser



PHOTOS BY K. MCLEOD

Quasar's apparel? The glow of a possible host galaxy *(red)* is brighter but more blurry in a ground-based image *(right)* than in HST view.