

The Nagarhole tiger controversy

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The small community of wildlife researchers and conservationists in the country has been rudely rocked by a controversy that has ramifications for the very freedom of scientific inquiry. It all began when five tigers died over a two-month period during March–May this year in the Nagarhole National Park in Karnataka. At the centre of the controversy is wildlife biologist K. Ullas Karanth, who is conducting research on tigers at Nagarhole. The state's then minister for forests accused Karanth of being responsible for the death of the tigers and issued orders banning the research project. Not only has a specific research project been stopped but other sweeping statements have been made by the minister to the effect that no research of any kind would be permitted in the forests of Karnataka.

The purpose of this article is to explain the nature of the research project, its utility or otherwise in the advancement of scientific knowledge and formulation of conservation plans for the tiger, the deaths of the tigers and whether the government is justified or not in accusing the researcher for these, and the implications of the controversy for future research in ecology.

The tiger research project

The research project, 'Ecology and management of large carnivores in Nagarhole National Park', was begun in 1986 by Ullas Karanth under an Indo-US collaborative venture. The principal American associate of the project is University of Florida's Melvin Sunquist, well known for his pioneering scientific studies of the tiger in Nepal using the technique of radio-telemetry¹. The early phase of the project in fact received funding from Karnataka's Department of Science and Technology through their Ecology and Environment Unit. From 1986 to early December 1989 the project did not involve any form of 'manipulative' research. During this period the herbivorous mammals in the park were censused intensively and

the feeding habits of the carnivorous mammals studied by examining their kills and scats².

Once the basic background information on the ecology of the park was built up, the project moved into its next phase—that of capturing tigers and leopards through chemical immobilization and fitting them with radio transmitters for subsequent tracking. This aspect of the research was cleared both by the Government of India through its Ministry of Environment and Forests and by the state government's forest department. During December 1989 and January 1990 four tigers and two leopards were collared. Later, another leopard, which had strayed into a village, was captured by the forest department and released in Nagarhole with a radio-collar fitted on it.

The procedure for collaring the tigers was as follows. Live baits, usually buffalo calves, were tied out in the park and regularly checked. The baits were fitted with radio-collars so that if there was a kill and the bait carried away, the carcass could be easily traced. Once a tiger took the bait the team moved into action. With the help of captive elephants the tiger was encircled with two long stretches of white cloth and slowly made to move towards a specific point where it was darted with a tranquillizer. The drug used was a mixture of a disassociative anaesthetic and a muscle relaxant: a combination of tiletamine hydrochloride and zolazepam hydrochloride for darting free-ranging tigers and ketamine hydrochloride and xylazine hydrochloride for leopards trapped in a cage³. These drug combinations, developed in the early seventies, have been used on many cats, including tiger, lion, jaguar and Florida panther, both free-ranging and in zoos. Under experimental situations they have been used when an animal is needed for surgery and must be down for 6–7 hours. According to Karanth the dose used for darting free-ranging tigers at Nagarhole was about one-third that of the surgical dose, which itself has a wide safety margin.

Once darted the tiger usually moves

no more than about 250 metres before going into a slumber. A temporary tent is put up to provide shade and the animal is cooled by pouring water over it. A specially designed collar with a miniature radio transmitter is fitted around the neck of the animal. The collar and the transmitter together weigh 800 grams; the general rule is that this should be less than 3% of the body weight of the animal. A surveillance is kept on the animal until it revives and moves away into the jungles. The time for revival varied between three and eight hours in the case of the darted tigers at Nagarhole. Karanth has asserted that all the tigers darted during the study revived successfully and there was no mishap. The four tigers, three males and one female, were all collared between 7 January and 29 January 1990. No further darting of tigers was attempted after this according to Karanth. The first tiger to be collared, an old male, had serious injuries, suspected to have been inflicted during a fight with another tiger, at the time of capture. This has been clearly documented on video tape and film.

The tiger deaths

The first tiger to be found dead was an adult male, on 6 March in the Hunsur range. The post-mortem examination, carried out by a government veterinarian, indicated pulmonary congestion, suggestive of some disease, which however was not diagnosed. On 27 March the old collared male with injuries was found dead. This was not really surprising because its imminent end had been predicted by the researchers. Its age has been estimated at over ten years. In zoos tigers have been known to live up to 15–20 years of age; in the wild animals usually die earlier.

Subsequently, an adult female (3–4 years) was seen dead on a road in the Kalthalla range. This also had several injuries, presumably from a fight; a broken tooth of another tiger was found lodged in its shoulder. Two other tigers, an adult male (3–4 years) and a young female (about one year), were seen alive in an injured state before they died on 28 April and 4 May respectively. The post-mortem reports also indicate death due to fights for these two animals. These deaths occurred at different places in the 641-square-kilometre

Nagarhole National Park. Apart from the old male none of the other tigers which died had been fitted with radio-collars.

After the third tiger death itself the Ministry of Environment and Forests of the Government of India conducted an inquiry through its regional deputy director for wildlife preservation based at Madras. This inquiry absolved Karanth of any responsibility for the death of the tigers. Later, Karnataka's chief wildlife warden also stated that there was no connection between the deaths of the tigers and Karanth's research project. Nevertheless, in June, the state's minister of forests openly accused Karanth of causing the deaths of the five tigers through overdosing with tranquillizers and issued orders withdrawing permission for the research project. He further threatened to fine the researcher Rs 50,000 for each of the tiger deaths and even confiscate his personal property. Karanth initially obtained from the state high court a stay on the research ban, whereupon the government withdrew its orders, only to reissue another ban order on 10 July. Currently the matter is once again back in the high court. The research project has essentially ground to a halt since June.

The issue became even more curious when the (then) minister asserted at a conference of veterinary doctors at Bangalore on 17 August that he had stopped the research because Karanth had already killed 11 tigers. If this were true, what became of the carcasses of the remaining six tigers that the minister alleged had died is a complete mystery.

Are the tiger deaths unusual?

The controversy throws up a number of issues for the scientific community in the country. Firstly, there is the crucial issue of the causes of the tigers' deaths. If overdoses of tranquillizers had indeed been responsible for any of the deaths, then there would have been cause for the government to react. In this case not an iota of proof has been offered by the government to show that the deaths were in any way related to use of tranquillizers. Even the old collared male tiger died some two and a half months after it was darted. A tranquillizer-related death would normally

have occurred within one day of the darting. Post-mortem examinations of the other dead tigers did not in any way implicate the tranquillizers. One might argue that the examinations were not thorough enough, but this merely emphasizes the point that the government's approach to the matter has not been very scientific. There are certainly capable scientists and institutions who could have been asked to investigate the affair, but no such thing has been done by the state government. It has proceeded in the matter on mere suspicion that drugs were responsible for the deaths.

This raises a related question as to whether the deaths of five tigers over a two-month period within a 641-square-kilometre area is unusual. Such an occurrence would be unusual if we expect tigers to die at random throughout the year. Karanth estimates that the tiger population within this area may be 40-50. The deaths thus seem to represent an approximately 10% mortality within a 2-3-month time span. However, there have been no other reported deaths of tigers other than these five (the minister's assertion of eleven notwithstanding) during the past year. The mortality of 10% should thus be taken as the rate for a year—certainly not an unusual death rate for tigers in the wild. Wild animals do not die off with regular clockwork precision. Spurts in deaths during the dry season due to lack of uncontaminated water and food for instance are well known for many wild mammals. The role of stochastic (random) processes on demography is indeed receiving increasing attention in recent years in the context of risk of extinction of endangered species⁴, but this may not be applicable to the Nagarhole deaths.

In fact it could be argued that a 10% annual death rate is actually a low rate when we consider that mortality rates for wild tigers may average 50% per year for the first two years of life^{1, 5, 6}. If we assume that just five tigresses in Nagarhole littered during the year, of the 15 cubs born (mean litter size is about 3) about 7-8 could have died before attaining one year of age. It would thus be safe to say that some more tigers should have normally died in Nagarhole, assuming that tigresses were breeding normally, but that their carcasses would have gone unnoticed in the dense jungle. (We should not cloak the tiger with immortality!).

Ironically, the entire controversy seems to have in a way resulted as an inevitable consequence of the management of the Nagarhole National Park during the past decade. Strict protection of the park against poaching by the forest department officials has meant a steep increase in the populations of herbivorous mammals such as spotted deer, sambar and gaur, upon which tigers largely prey. The biomass of mammals here is very high, about 15 tons per square kilometre, and comparable to that in the famous wildlife parks, such as Serengeti-Mara in Africa. This has led to an increase in the populations of carnivorous mammals, including the tiger. It is no secret that the best chance of seeing tigers in the wild in southern India (very difficult indeed) is at Nagarhole.

Both male and female tigers are territorial. With such a high density (one tiger per 12-15 square kilometres) of tigers, comparable to or higher than those attained in prime tiger habitats elsewhere in Asia, it is conceivable that the stage is set for intense intraspecific competition and aggression. Males compete for territory and dominance in the social hierarchy to ensure better access to tigresses for mating¹. Young males dispersing from their natal territories are especially vulnerable and so are old males who may be ousted by younger and healthier rivals. When a male tiger gains access to a tigress it may also try to kill her young cubs from a previous litter. The death of even one dominant male tiger could for instance trigger off a series of events as the remaining males shift territories. A spurt in aggression during a short span of time is thus a distinct possibility. Tigresses also establish territories to ensure access to food, cover and other resources needed for their own and their cubs' survival⁷. Aggression between tigresses is also known. Aggression-related death is thus entirely plausible for the tigers of Nagarhole.

The persistent sceptic may still ask whether the tigers could have died owing to use of tranquillizers; that is, some tigers may have been darted but not collared. Certainly, there must be some risk involved in the use of drugs. In studies carried out during the seventies and eighties in Chitwan in Nepal, over 50 dartings of tigers, representing 26 tigers (some tigers were

darted more than once to replace collars and so on), were done. There were two casualties. One tigress died owing to increase in body temperature; this was before tents were used to provide shade. Another tiger died after darting because it moved into a water-hole and drowned; in this case the drug itself was not directly responsible. The risk factor can thus be seen to be less than 5% from this, large enough, sample. Whether this is an acceptable risk or not is an issue I shall deal with later. In the Nagarhole affair there is simply no evidence to implicate the use of drugs in the tigers' deaths. All the tiger deaths were reported and not hushed up (which could have been done if there was any foul play). Karanth is a qualified wildlife biologist, with an MS from the University of Florida, and his past record as an ardent conservationist does not give room for any suspicion of irresponsible behaviour towards the tigers of Nagarhole—after all, he is out to study the species and not to eliminate it!

Why study the tiger?

Is there any need in the first place to study tigers? One can think of two basic reasons for studying tigers, or any other species for that matter. The first has simply to do with advancement of knowledge for its own sake. Man has an inherent curiosity for understanding the world around him. Whether he contemplates the mysteries of a black hole or sequences the genetic material of a virus, he does not need to justify the pursuit of so-called 'basic science'. When a scientist is supported by public money, there usually arises a demand to pursue so-called 'applied science', to produce knowledge that is of use to society. Actually good applied science inevitably depends upon good basic science.

Apart from saying that Karanth may be studying the tiger simply because he is fascinated by it, one can justify the study by its value to conservation efforts to save the tiger from extinction. It would be ideal if tigers had half the earth to roam at will and go about their own business. We could probably then have a hands-off policy on the species. However, this is certainly not the case today. The tiger has been eliminated over most of its former range through

hunting by people and loss of habitat. Its precarious position is well known. In India the population of the tiger is believed to have come down from an estimated 40,000 at the beginning of this century to about 2000 in the early seventies when Project Tiger was launched to save the species from extinction. Although it is impossible to give an exact population figure, it is currently estimated that there are between 3000 and 4000 tigers in the country. Even then, their habitat is highly fragmented, resulting in numerous small tiger populations which can be expected to lose genetic variation due to drift and inbreeding⁸. Such populations may not have any evolutionary potential in the absence of human intervention. We are today at a stage where interventionist management such as translocating animals between populations to maintain genetic variation is necessary for conserving many endangered species including the tiger.

Management of a species needs considerable scientific input concerning the biology of the species. For the tiger this would include information on its habitat-space requirements, its social organization and the relationships among different individuals in a population, its prey requirements, its reproductive biology and population dynamics, and the genetic structure of the population. Apart from the study in Nepal¹, very little scientific information is available on many of these aspects for wild populations. Karanth's research covers practically all these aspects and should result in interesting new information on tiger biology. In addition there is the possibility, in the case of some tiger populations at least, that they may come into direct conflict with people—witness the man-eating tigers of the Sunderbans or those of the Dudhwa National Park. Managing a problem population certainly requires research input.

Why use radio-tracking?

In the open grasslands of the Serengeti many mammals can be studied with nothing more than a pair of binoculars. It may even be possible to identify individuals and follow their lives over long periods of time. Cynthia Moss and her associates have successfully done such long-term research on the elephants

of Amboseli in Kenya⁹. However, in dense forest the sighting of an identified animal is simply a matter of chance, and data collection may turn out to be a haphazard process. One may wish to have a certain amount of data collected each month or season for particular individuals but this may be impossible. There may be some months when the individuals of interest may not be seen at all. With a creature like the tiger one may have to be satisfied with a few fleeting glimpses during the entire duration of a study.

Radio-tracking opens up the possibility of locating an individual at will. It enables the accumulation of a large, systematic body of data, which can be used to do statistical tests of specific hypotheses. This technique has been in vogue for at least three decades and animals ranging from rodents to elephants have been studied in most parts of the world by biologists. With the electronics revolution the technique has become extremely sophisticated. Today animals are being radio-tracked by satellites. A recent study on the albatross revealed that it travels 12,000 km on a single foraging trip—information that cannot be obtained by conventional means. India has been very slow to take to this because of a morbid fear that anything to do with radio transmitters, especially ones introduced by foreigners, surely meant spying and a threat to national security. During the past few years this seemed to be gradually changing. One of the first systematic studies of a large mammal using radio-tracking has been recently carried out on the lions of Gir by researchers from the Wildlife Institute of India. Seven lions were darted and collared without any mishap, and their movements followed for two years. The Nagarhole controversy threatens to shut the doors once again to use of such technology by Indian biologists.

With the technology we now have to radio-collar a large animal, it has to be inevitably captured and anaesthetized¹⁰. Is it worth taking the risk of using drugs to capture an endangered species? Clear policy guidelines will have to be laid out by the government on this issue in consultation with scientists and conservationists. Decisions on whether to allow the use of tranquillizers on a species will depend on its population size and the degree to which it is

endangered in relation to the risk of mortality during darting and the potential benefits of the study to its conservation. If a species has only 10 individuals and a very high chance of extinction, and the risk of death due to darting is 50%, it would of course be foolish to allow any use of tranquillizers even for research. In the case of tigers, which number 3000-4000 in the country, it would be worth facing the risk of one or two deaths from darting if the benefits from the research to the conservation of the species could be expected to ultimately outweigh these costs.

It must be emphasized at this stage that the use of tranquillizers is not akin to 'screw-driver technology' in electronics, and that they should be handled only by skilled, trained people. It would be in the interests of all parties concerned to ensure that the operation of darting and collaring a charismatic creature like the tiger or the elephant (nobody might kick up a fuss if you kill a hundred rats by darting) is a team effort, attended by concerned administrators and competent veterinarians. It should not, however, be turned into a spectator sport as this can only cause utter confusion and lead to accidents. Once policies are laid down and permission given for the collaring of animals, an individual researcher should not be singled out for attack by the same government if there is any unfortunate mishap.

Implications for ecological research in india

The controversy brings up a number of other issues, relating to the rights of researchers to freedom of inquiry, in the wake of irresponsible, sweeping statements made by many politicians. I give below a sample of such utterances reported in the media.

What is there to study about the tigers? No amount of study can change the behaviour of tigers. It can't be transformed into either a fox or an ox for ploughing.

... (the researchers) have given the impression that the tigers died due to fighting among themselves, territorial supremacy, old age and starving, which were unknown to wildlife.

If the male tigers are collared the females are not going near them, and vice versa. Therefore there are no newly-born cubs in Nagarhole.

Please tell the forest researchers not to come near our forests. [This was in response to a suggestion that research on bamboo cultivation could be used by the department, probably a reference to the new technique of inducing flowering by researchers from National Chemical Laboratory, Pune, which has received wide publicity.] Under no circumstances would any research on wildlife be allowed in Karnataka's forests.

These statements range from the utterly comical (why on earth should a tiger be transformed into a fox or an ox?) to the absurdly unscientific (nature is red in tooth and claw; what happens during old age if not death?) and the unconstitutional (the right of an individual to pursue knowledge, if used in a responsible fashion, cannot be taken away by the government). While the absurdities can simply be ignored as bad jokes, what should concern every scientist is the blatant attack on freedom to do research in forests. It is like saying that the mysteries of nature should not be probed. A physicist or a chemist engaged in experimental work within the confines of the laboratory need never interact with the outside world if they so wish. To an ecologist nature is often the laboratory, an arena where there is constant interaction with administrators and the public. Research may often depend on the 'good relations' one has with them. At a period when environmental issues are emerging as crucial for human survival it is all the more regrettable that a minister should want to put an end to all research in forests.

When it comes to granting permission to do research, a basic right to do non-manipulative research should be first recognized. If a researcher wants to look at a particular bird with binoculars, why should the government prevent this, as long as there is no interference with the bird's life? When research involves collection of specimens there should be regulation, depending on their impact on the species (most collection in wildlife research involves nothing more than taking tissue samples and skulls from dead creatures). As I said earlier there should be clear policy guidelines for more-invasive research such as tranquillizing and radio-collaring.

What is a sensible approach the government could have taken in the Nagarhole matter? If there was a strong suspicion that tigers had died due to use

of tranquillizers the state government should have appointed a team to probe the matter thoroughly. If drugs had been suspected, it could be argued that poisoning of tiger kills by the public should have also been considered (this has been one of the main causes of deaths of tigers in India after independence). The government could have asked the researcher to stop any further darting of tigers until the issue was settled, but permitted him to continue with his research on the animals already collared. What harm can befall the three tigers and three leopards collared and alive if they are followed with the aid of nothing more potent than a radio receiver? After all, a lot of money and effort has gone into the research project over the past four years. The minister for forests did none of these things. With a completely closed mind he ordered that the research project be wound up. The loser is not just Karanth—it is also the scientific community, the government which claims to champion the cause of wildlife, perhaps even the tigers of Nagarhole.

1. Sunquist, M. E., *Smithsonian Contrib. Zool.*, 1981, No. 336.
2. Karanth, U. K., MS dissertation, University of Florida, USA, 1988.
3. Seidensticker, J., *J. Zoo Anim. Med.*, 1974, 5, 22.
4. Soule, M. E. (ed.), *Viable Populations for Conservation*, Cambridge University Press, 1987.
5. Schaller, G. B., *The Deer and the Tiger*, University of Chicago Press, 1967.
6. Singh, A., in *The World's Cats* (ed. Eaton, R. L.), Van Nostrand Reinhold, New York, 1974.
7. Smith, J. L. D. et al., in *Tigers of the World*, Noyes Publications, Park Ridge, New Jersey, 1987.
8. Frankel, O. H. and Soule, M. E., *Conservation and Evolution*, Cambridge University Press, 1981.
9. Moss, C., *Elephant Memories*, William Morrow, New York, 1988.
10. Harthoorn, A. M., *The Chemical Capture of Animals*, Balliere Tindall, London, 1976.

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