Clean chit to wildlife conservation

A new study shows that the process of fitting radio collars, which allows monitoring numbers and movement of animals, does not compromise their safety

S ANANTHANARAYANAN

Could the tools of conservation lead to extinction of wild life? The last half century was marked by global awareness of biodiversity that the earth has lost to the growth of industry. This has brought in laws where industry needs to be responsible towards the environment and worldwide efforts to revive the wild-life that remains. In 1992, however, an authority on wild-life conservation arrived at a conclusion that the methods of conservation, since 1964, may be the unwitting reason for extinction of some dwindling species.

Craig R Jackson, Emmanuel H Masenga, Ernest E Mjingo, Andrew B Davies, Frode Fossøy, Robert D Fyumagwa, Eivin Røskaf and Roel F May, of the Norwegian Institute for Nature Research, the Norwegian University of Science and Technology, Tanzania Wildlife Research Institute and the Carnegie Institution for Science, at Stanford, describe in the journal, *Ecology and Evolution*, their study that enables ecologists to take an informed view about this disturbing notion.

The question was first raised, in September 1992, by Roger Burrows, of the University of Exter, UK, in a letter to the journal, *Nature*. Burrows referred to rising incidence, in Serengeti National Park, Tanzania, and adjoining conservation areas in Tanzania and Kenya, of death of whole packs of *Lycaon pictus*, or the African wild dog. Burrows noted that wild dogs, which were among the most endangered of carnivores in Africa, were also the subject of much study and research. The research involved immobilising the animals and fitting them with radio collars. And some animals were vaccinated against rabies. Burrows noted that in 1989, a whole Kenyan pack had died from rabies, a disease not usual with African wild dogs. The dogs that died, Burrows said, included some that had been handled by researchers for radio collaring and for vaccination against rabies. And between 1985 and 1990 in the two conservation areas, four of eight packs, though not vaccinated, died within two to five months after radio collaring. And it was known that one pack had died of rabies.

As rabies was feared, seven other packs that were being studied were then vaccinated against rabies. All these seven packs, Burrows said, died or disappeared within a year of vaccination. Although there was no evidence of rabies in the area, rabies was suspected. At the same time, packs that had not been vaccinated, and not fitted with radio collars, had not been affected. This pointed a finger to either radio collaring or to vaccination. The need for vaccination itself was not clear, as there was evidence that the packs had been exposed to rabies and some individuals had significant levels of rabies anti-bodies.

Burrows again noted that the stress of immobilising and "handling" raises the levels of cortisol, a substance that suppresses the immune response, which could have revived latent rabies viruses. This was contested, and the Univ of Oxford regretted that "the debate has been fermented by inadequacy of data of the fates of 'handled' lycaon of the ecosystem" and made a plea for more study. "…but the conservation of this marvelous species in an ecosystem it has helped make famous deserves the highest standards of scientific application," the letter said.

Roger Burrows and those who agreed with him, however strongly defended what has come to be known as "*Burrow's hypothesis*". A paper by Burrows in 2011 strongly indicts conservation intervention, saying , "14 packs ….died or disappeared from two study areas in the Serengeti-Mara ecosystem of Tanzania and Kenya, in East Africa, where the species had been considered a "flagship species" for conservation…The ecosystem population did not become extinct in 1991, a non study population persisted within and around the ecosystem throughout the study period and persists to date…All study packs were the subject of conservation research by scientists who routinely used invasive research techniques (known as 'handling')…"

The paper also strongly attacked the arguments of opponents, often citing the reason of the data for contradiction being inadequate. As a result, the question stayed undecided and the value and the safety of research methods was called in question. And in many administrations, the practices of immobilisation, the radio collar and immunization were stopped.

The Serengeti ecosystem covers 30,000 square kilometers in Tanzania, has rivers, forests, wooded mounds, grasslands and is home to 70 mammal and 500 bird species. And then to large numbers of lions, leopards, spotted hyenas and panthers. The seasonal migration of, 260,000 zebra, 1.7 million wildebeest, 470,000 gazelles and hundreds of thousands of other game, following grazing plains, through the reserve, into Kenya in the north, is surely the largest known mass movement of animals, in parallel with long distance migration of humpback whales and in numbers, with the migration of birds or insects, and bats. The collection of crowded grazing animals is a bonanza for carnivores and large numbers of the animals, including many that fall to crocodiles during the crossing of rivers, never reach their destination.

Development of Serengeti as a major biodiversity and wild-life ecosystem has led to sophistication in the methods of observation, census taking and management of resources or topography. An important technique is the placing of camera traps, which captures animal movement, unobtrusively, and with automation, over months together, enabling huge data collection. In this context of massive data collection, the group writing in Ecology and Evolution decided that if it was lack of data that was in the way of deciding the truth of the Burrow's hypothesis, then it was time to collect the data needed.

The group saw that while the wild dog population had disappeared inside Serengeti National Park, the animal was not extinct and there were packs that lived in ranges just outside the National Park. To assess the hypothesis that 'handling', by way of immobilisation and fitting of radio collars, would reactivate latent rabies viruses, the group collected data of wild dog immobilisations carried out in the park since 1991. Data was collected of 121 immobilisations between 2006 and 2016, using the same method of air-pressure-driven darts, and the welfare of the 121 wild dogs in the next three, six and twelve months was monitored. To allow for the objection that a single immobilisation was a "short term" stress, six packs of wild dogs that were immobilised, between 2012 and 2016, in the adjoining Loliondo Game Controlled Area, were then captured, confined, loaded in crates, transported and released in unfamiliar settings in Serengeti. This, in comparison with immobilisation for fitting the collar, was severe stress, and according to the Burrow's hypothesis, should have resulted in increased mortality. The survival in the group of wild dogs that had been handled and relocated was then compared with that of a similar group that had been exposed to 'short term' stress of only handling, without relocation.

Of the 121 animals relocated, it was found that 95.9 per cent survived for three months, 91.7 per cent for six months and 87.6 per cent for a year or more. This certainly did not suggest that severe stress could cause reactivation of rabies viruses or other causes of mortality. In fact, it had been seen that in six packs that had been handled and translocated to Serengeti, the survival rate for a year, at 95.5 per cent, was greater than the 77.8 per cent of animals that had been handled but not translocated. Another significant fact noted was that while numbers of wild dogs increased around the Serengeti park, creating pressure for new packs to seek territory, camera trap records showed that there was no recolonisation of Serengeti.

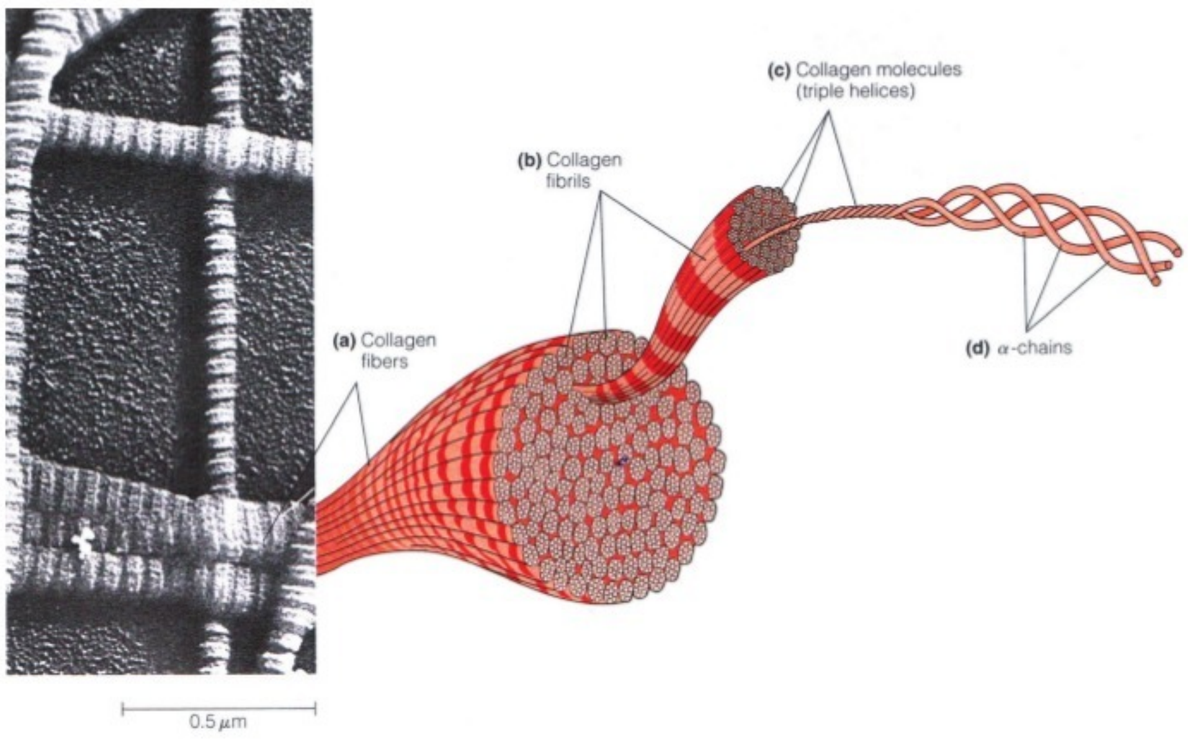
The evidence thus shows that handling, for fitting radio collars, which enables monitoring of numbers and movement of animals, does not compromise their safety. It may have been environmental factors or inter-species competition that led to the decline of the wild dog in Serengeti. "Consequeny, in the case of the African wild dog, information gained through research involving radio telemetry and other interventions has most likely contributed to the conservation of the species as a whole, rather than compromised it," the paper says.

The writer can be contacted at response@simplescience.in

Provider of strength

Considered collectively, collagen is the most abundant protein in vertebrates, accounting for as much as 25 to 30 per cent

TAPAN KUMAR MAITRA



Collagens are responsible for the strength of the extracellular matrix. The most abundant component of the ECM (Extracellular Matrix) in animals is a large family of closely related proteins called collagens, which form fibers with high tensile strength and thus account for much of the strength of the ECM. Considered collectively, collagen is the most abundant protein in ver-tebrates, accounting for as much as 25 to 30 per cent of total body protein. Collagen is secreted by several types of connective-tissue cells, including fibroblasts. Without collagen, cells in these and other tissues would not have sufficient adhesive strength to maintain a given form.

Two defining characteristics are shared by all collagens: Their occurrence as a rigid triple helix of three intertwined polypeptide chains and their unusual amino acid composition. Specifically, coiiagens are high in both the common amino acid glycine and the unusual amino acids hydroxylysine and hydroxyproline, which rarely occur in other proteins. The high glycine con-tent makes the triple helix possible because the spacing of the glycine residues places them in the axis of the helix, and glycine is the only amino acid small enough to fit in the interior of a triple helix.

In most animal tissues, collagen fibers can be seen in bundles throughout the extracellular matrix when viewed by scanning electron microscopy. One of the most striking features of collagen fibers is their enormous physical strength. For example, it takes a load of more than 20 pounds to tear a collagen fiber just 1 millimeter in diameter! Not surprisingly, collagen is largely responsible for the mechanical strength of protective and supporting tissues such as skin, bone, tendon, and cartilage. Each collagen fiber is com-posed of numerous fibrils. A fibril, in turn, is made up of many collagen molecules, each of which consists of three polypeptides called chains that are twisted together into a rigid, right-handed triple helix. Collagen molecules are about 270 nm in length and 1.5 nm in diameter and are aligned both laterally and end-to-end within the fibrils. A typical collagen fiber has about 270 collagen molecules in cross section.

A precursor called Procollagen forms many types of tissue-specific collagens. Given the complexity of a collagen fiber, it is important to ask how such an elaborate structure is generated. In the lumen of the endoplasmic reticulum (ER), three a chains assemble to form a triple helix called procollagen. At both ends of the triple-helical structure, short nonhelical sequences of amino acids prevent the formation of collagen fibrils as long as the procollagen remains within the cell. Once procollagen is secreted from the cell into the intercellular space, it is converted to collagen by procollagen peptidase, an enzyme that removes the extra amino acids from both the N- and C-terminal ends of the triple helix. The resulting collagen molecules spontaneously associate to form mature collagen fibrils, which then assemble laterally into fibers.

The stability of the collagen fibril is reinforced by hydrogen bonds that involve the hydroxyl groups of hydroxy-proline and hydroxylysine residues in the chains. These hydrogen bonds form crosslinks both within and between the individual collagen molecules in a fibril. In addition, specialised types of collagen are often present on the surface of collagen fibrils. The triple-helical structure of these specialised collagens is interrupted at intervals, allowing the molecules to bend and hence to serve as flexible bridges between adjacent collagen fibrils or between collagen fibrils and other matrix components.

Vertebrates have about 25 different kinds of a chains, each of which is encoded by its own gene and has its own unique amino acid sequence. These different a chains combine in various ways to form at least 15 different types of collagen molecules, most of which are found in specific tissues.

The writer is associate professor and head, department of botany, Ananda Mohan College

PLUS POINTS

Shield for neurons

Scientists from the University of Sheffield have identified new messenger molecules shuttled between cells which could help to protect the survival of neurons-- potentially leading to new treatments for Motor Neurone Disease (MND). The research has discovered the role of a small molecule which can regulate large signalling cascades and significantly improve the survival of neurons-- something which will help pave the way to identify and develop new therapies for neurodegenerative diseases.

MND, also known as Amyotrophic Lateral Sclerosis (ALS), is a devastating neurogenerative disorder that affects the motor neurons-- in the brain and spinal cord that tell our muscles what to do. The messages from these nerves gradually stop reaching the muscles, leading them to weaken, stiffen and eventually waste. The progressive disease affects a patient's ability to walk, talk, eat and breathe. MND affects 5,000 adults in the UK and there is currently no cure.

Approximately 10 per cent of MND cases are inherited but the remaining 90 per cent are caused by complex genetic and environmental interactions which are currently not well understood-- this is known as sporadic MND. The most common known genetic cause of MND is a mutation of the C9orf72 gene.

Although MND affects the survival of neurons, other supporting cell types such as astrocytes-- star-shaped glial cells in the brain and spinal cord - play an important role in the progression of the disease. In MND, the extracellular vesicles (EVs) can contain toxic factors - no longer supporting the neurons but instead contributing to their death.

The new research, led by Laura Ferraiuolo from the University of Sheffield's Insitute of Translational Neuroscience (SITraN) found that when the micro-RNA molecule-- which can regulate large signalling cascades is introduced to an astrocyte-motor neuron culture, the survival of neurons was significantly improved.

The micro-RNA identified in the study, called miR-494-3p, regulates genes involved in maintaining the health and strength of neurons axons. Researchers also found miR-494-3p was significantly depleted in cells derived from patients with sporadic MND.

The research, in collaboration with Guillaume Hautbergue's team at SITraN and Stuart Hunt's lab in the University of Sheffield's Dental School, is published in the Journal EBioMedicine recently.

Younger brains

Women tend to outlive men and stay mentally sharp longer, a new study could explain why, female brains appear on average about three years younger. The study enrolled 121 women and 84 men, who underwent PET scans to measure brain metabolism, or the flow of oxygen and glucose in their brains.

Like other organs in the body, the brain uses sugar as fuel. But just how it metabolises glucose can reveal a lot about the brain's metabolic age.

Subjects ranged from their 20s to 80s, and across those age spans, women's brains appeared metabolically younger than men's, said the findings in the Proceedings of the National Academy of Sciences, a peer-reviewed US journal.

A machine-learned algorithm showed that women's brains were on average about 3.8 years younger than their chronological ages.

And when compared to men, male brains were about 2.4 years older than their true ages. But what can be the reasons? One theory is that hormones might begin shaping brain metabolism at a young age, setting females on a pattern that is more youthful throughout their lives, compared to men.

Scientists hope to find out if metabolic differences in the brain may play a protective role for women, who tend to score better than men on cognitive tests of reason, memory and problem solving in old age.

It "could mean that the reason women don't experience as much cognitive decline in later years is because their brains are effectively younger," said Goyal.

More work is underway to confirm and better understand the implications of the research.

The straits times/ann