



Scientific Methods in Protection of Wildlife: A Need of Time

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ABSTRACT

Wildlife is an essential part of wholesome environment which needs the special care and attention toward its preservation and prevention of crimes through effective legal and scientific mechanisms. Now world has moving towards the inclusion of technology in every sphere of human life. Here law and science are mediums of achieving the ends for the betterment of lives and welfare of humans. Forensic science has been emerging as a great aid in conducting the effective investigation against wildlife crimes. This article points out certain methods of forensic science in relation to the law in India, and their utility, so that the cherished right of wholesome environment can become a reality.

Keywords: Forensic Science, Wildlife, Environment, Law, Evidence, Crime, D.NA.

INTRODUCTION

Forensic Science is, in simple term, application of various branches of sciences in the areas of law. The Supreme Court of India has recognized the Right to Wholesome Environment for everybody (*Subhash Kumar v. State of Bihar*), and undoubtedly, wildlife has been the vital contributor in wholesome environment, without which we cannot imagine the world as good and pleasant as it is today. Thus the need arise of protection and conservation of wildlife in its natural state. Today one of the single biggest global challenges is the trafficking of animals and their derivatives, the cost of which is estimated at US \$10–20 billion per year, roughly 5% of the international drug trade (Wison-Wilde L (2010)). Although, India has The Wildlife (Protection) Act, 1972, yet, the crime against wild animals going on at intense rate causing the fear of extinction of the same. Problem often arise when investigation agencies failed to establish the guilt of accused persons after nabbing them or failed even at investigation stage to gather sufficient evidence against the culprits.

Now time has change and it is the need of the time to investigate the crimes against wild animals by using modern scientific technology and methods, because a vigil can be keep on the movements of animals as well as of

humans in forests by using the electronic equipments like CCTV Cameras. In this endeavour, wildlife forensics can be of great use. Wildlife forensics is an emerging field which has been applied extensively by the Investigation Agencies because it is useful not only in monitoring the health and well-being of wild animals in the jungle, but most importantly, it is useful in getting relevant evidence against the perpetrators of crime. This effort involves a number of different players drawn from the international community, national police agencies, NGOs and forensic specialists (Bell L.S. (2011)).

SCIENTIFIC METHODS OF IDENTIFICATION

Anstett et al, 2016 in their study points out various scientific practices underpinning the social re-inscription of the human and animal remains resulting from violence focuses on the historical configurations that presided over the birth of physical anthropology. This has been done through techniques of identification, classification and display.

Again Identification methods may be useful in preserving and protecting the wild animals during their life time, which is in fact more important as they make the ecological balance. On the other hand, in case of death of

animal, cause of the death whether natural or because of intentional killing on the part of humans, can be traced out by way of using the scientific methods.

(i). Shaving or Cutting the Fur:

According to Dahlborn *et al* (2013) Cutting of some fur or scales of skin is of a wild animal is simple-most method of keeping the material for identification of animals. But for this purpose it is necessary to make an animal unconscious by applying some chemical or tranquilizer gun.

(ii). Felt Tip Marker:

Felt Tip Marker or Alcohol-Based Pens for Skin Marking, including Coat Dying is another good technique of identification of animals, because here it is possible to give identity to an animal by writing numbers or marks on the hairless parts of the body of that animal. Such marks may be read from distance and that too, without capturing that animal.

(iii). Subcutaneous Injection of Ink:

In this method, ink is injected through a needle into the skin of an animal which makes the skin coloured. However, injection involves a pain as reported by Leclercq and Reozefeld (2001), but it is submitted that for the sake of protection and care of an animal, this aspect of pain is ignorable.

(iv). Ear Tag:

Ear Tags may be of plastic or metal (Generally of Nickel copper), and may be different for different species of animals. Ear Tags are also good way of marking the animals which help them to identify in case of need.

(v). Tattoo Method:

Tattoo can be encrypted on numerous parts of animal like tail, nose tip, footpads, toe etc. some animals may be sensitive to the ink applied on their skin so it becomes necessary to assess and ensure this aspect also that suffering of the animal must be eliminated. This is a permanent method of identification as either the tail, footpads or toes of an animal get tattooed. Ink must be loaded in the dermis of animal, under the epidermis so a permanent mark may be created (Hawkins *et al*, 2004).

This may include Tail Tattoo, Ear Tattoo by applying the micro tattoo system or electrical tattoo equipment. This proved good in the case of identification of rodents (Hankenson *et al*, 2008). An alternative to the Electric Tattoo Machine is the use of a lancet, which is done manually and reflected in coloured dots only. Similarly, Toe tattoo or footpad tattoo is another way of fixing the identity of wild animals but this kind of tattooing is worthy in rodents and other small animals because large animals can be better coloured on their skins in permanent way.

(vi). Microchip Transponder:

Microchip insertion in skin of animals another effective way of keeping the vigil on the movement and studying the habits of animals. Microchips, generally known as Electronic Radio Frequency Transponders, by way of small surgery inserted subcutaneously, and the location of animal can be traced out by way of readings in the transponder reader. Most readers easily get connected with the computers and become very useful in collection of variety of data (Dahlborn *et al*, 2013).

(vii). D.N.A. Identification:

Deoxyribonucleic Acid (D.N.A.) Identification is a new and reliable method of identification and this technique now overtaken almost all preceding techniques of identification. For this purpose sometimes scientists need the small notch of tissue of an animal while on the other hand some hair or saliva or urine of animal is sufficient to collect D.N.A.

Now the above-mentioned methods are very effective in protection and conservation of wild animals and for their welfare. But not all the times these can be applied because on many occasions, investigation needed to be done after the commission of crimes against the wild life. Thus, some other scientific methods are also here which may be useful in wildlife crimes. There are two kinds of methods of identification of animals in case if they injured or hunted and their remains later found. These two methods are (1) Morphological Methods, and (2) Chemical Methods.

I. Morphological Methods:

The Morphological Analysis includes number of methods like osteology, microscopy etc. to examine the same structure. This analysis breaks down a product, system or process into various sub-categories. Each category, stating a particular dimension in multi-dimensional matrix. The morphological methods used in wildlife forensics are utilized primarily for identification and to ascertain cause and manner of death. These methods are based on anatomical identification of tissues or body elements and require a considerable understanding of comparative anatomy at the macroscopic and microscopic scale. Some of the Morphological Methods are discussed below:

A. Osteology:

Louise Scheuer (2002) states that Forensic Osteology is a branch of larger subject of forensic anthropology that includes the study of facial super-imposition, facial reconstruction, forensic odontology, bone pathology, and archaeology. However, in general, Osteology is the study of bones of a skeleton. Osteologists when apply the science of osteology, study and use the unique appearance or morphology of bony elements of the skeleton in order

to make identifications. However, this may be easy in the matters of human being's identification but animal identifications are far more difficult to make because there are so many possibilities and inter-species and intra-species variants. Where whole or partial bony elements survive, the bony joints, overall size and shape, and ligamentous insertion sites provide diagnostic identifiers (characteristic traits) of species and are ranked collectively (Lyman RL, 2001).

An Osteological Analysis includes examination of skeletal remains, a dental structure, aging data, based on study of epiphyseal fusion and dental budding or growth (for sub-adults) and deterioration or withering of pubic symphysics or sterna end of ribs, stature and other metric data, non-metric traits, ancestry (both in case of humans and animals) etc. It, thus, becomes possible to identify a single bony element depending on its diagnostic attributes. This approach is also used to estimate minimum numbers of individuals present by using a single skeletal element such as, say, right proximal femur. This is important where many body parts are collected together for shipment and an estimation of animal count is required. When dentition is present, the chance of identification vastly increases, since dentition is unique to most species (Hillson S, 2005).

B. Microscopy;

Even trace elements may be crucial in solving the crimes. Although most forensic scientists use microscopes at one time or another, the forensic microscopist uses microscopes to locate, recover, identify and compare trace evidence as a part of crime investigation. Where fragmentary material is recovered, microscopic identification is possible with animal material and a sizable literature exists. Microscopy is a technology capable of analyzing microscopic samples found at the crime scene like fragments of hairs, feathers, scales, fibres etc. and also to trace out gunshot residue (in the cases of hunting), which may provide vital information and the same can be of great help in solving the mystery of crime against wildlife (Priya Thakur, 2021). A useful review by Hillier and Bell (2007) outlines the different microscopic morphologies associated with animals, and how they differ from one another as well as from humans. One success using microscopic identification has been its application to the problem of identifying traded ivory. The principal source for ivory is the elephant, either Asian or African—or alternatively, from the extinct Pleistocene mammoth. Although trade in Asian and African elephant ivory is prohibited (with occasional internationally permitted sales contradicting this statement), trade in mammoth ivory is unrestricted, and its exploitation has existed for centuries. Most mammoth ivory originates from Siberian deposits (Bell L.S., 2011).

Available data, according to World Wild Life Crime Report (2020) shows that poaching over the last decade undoubtedly accounts for significant portion of wild elephants killing, potentially resulting in some one thousand metric tons of illegal ivory over the decade, or an average of about one hundred tons per year. However, it is submitted that honesty on the part of Investigation Agency is pre-requisite while collecting the material relating to evidence otherwise in case of absence of data, no microscopy technique can be of any use.

C. Necropsy:

Necropsy is the animal equivalent of the human autopsy and is performed by a trained veterinarian, with a subspeciality in pathology. It is included in the morphological methods section since it is classically anatomical in nature, and relies heavily on visual observation, radiography, and microscopy (Cooper *et al*, 2008). Other tests may be performed, such as toxicology and histopathology, but it remains very much a visual hands-on investigation. For wildlife crimes, the necropsy is important where determinations of cause and manner of death are required. In British Columbia, Canada, black bears are poached by traffickers for their gall bladders, and their carcasses or parts are subsequently illegally exported to China to supply the traditional medicine industry. Using this example, a necropsy can determine what organs have been removed and also how that animal was killed. Depending on the condition of the body a time of-death estimate might also be made. This type of information is immensely important to police investigators and to international organizations attempting to localize traffickers and their methods. It is also important forensic evidence for the court.

II. Chemical Methods:

Some of the important Chemical Methods are discussed below:

A. Toxicology:

Forensic toxicology usually involves two separate efforts: first, to identify chemical compounds that have been synthesized from animals illegally; and second, to identify poisoning, either deliberate or accidental. Analyses usually involve thin layer chromatography (TLC) or high-performance liquid chromatography (HPLC) and are undertaken by specialist chemists. Samples are taken either during necropsy or from confiscated organs/tissues or other derivatives. One of the most well-documented wildlife crimes is the slaughter of bears for their body parts, particularly the gall bladders. The harvesting of bile from bear gall bladders is an ancient practice in China, and the bile is considered a potent healing ingredient in traditional Chinese medicine. This potency has driven a black market

trade in bear gallbladders from all over the world, and the value of these organs has jumped significantly: in 1970 a kilo of gall bladder cost US \$200; today gall bladders can trade as high as US \$50,000 (Feng, 2009) .

B. Identification of Poisoning:

Where a poisoning incident has taken place and samples are taken in a well-documented time-frame, it is often possible to identify the poisoning agent. Validation and verification are possible due to extensive chemical reference libraries. However, the physiology of different species and the degradation metabolites can make identification more difficult. Vultures are under significant threat in different parts of the world and deliberate carbofuran poisoning of vultures in Kenya was detected as toxic residues in beak, feet, muscle, and soil (Otieno *et al*, 2010). Carbofuran is known to be highly toxic to birds and is banned as an agricultural pesticide. But in Kenya it is legally used for certain agricultural practices, plus, in many countries, there is a general lack of regulation. This poison is administered by baiting/lacing a carcass to deliberately attract and kill secondary predators such as vultures. This method has been documented and can cause mass death of vultures from one carcass alone.

In Spain, a monitoring study revealed that targeted poisoning caused a large number of vulture deaths across the country, and the compounds found to be most used were aldicarb (38.6%), carbofuran (31.3%), and strychnine (16.6%) Hernandez (Hernandez *et al*, 2009). The main motivation for this type of wildlife crime is a desire to eradicate or reduce avian predator populations who are deemed in competition with land owners and farmers

C. Stable Isotopes:

Stable light isotope tracking of human and mammal remains in geographic space which is also known as biogeolocation, biosurveillance, and isoscapes. The initial interest in this field was focused on reconstructing past climate temperatures, where fossil mammal bone and teeth were utilized as proxy indicators of climate temperature. Archaeologists adapted this temperature relationship to answer questions concerning geographical movement of past human populations (Bell *et al*, 2010). Forensic science has a direct application for this type of work, since knowledge of where someone lived either months or years prior to death can help narrow a missing-person search. The potential to expand this kind of work into wildlife forensics is obvious (Aggarwal *et al*, 2008) since it can address the question, “Where did this come from?” and the jurisdictional implications that go with that.

D. Genus-Specific Peptide Markers:

An emergent archaeological method developed for the identification of different mammal residues in potsherds or recovered as bone fragments, could also be applied to wildlife questions concerning identity (Buckley *et al*, 2009). The results indicate that this is a viable method for separating species at the genus level, and managed to successfully separate the difficult question mentioned earlier: the differentiation of sheep and goat. The authors make the point that this method might be used as an alternative to DNA identification, where DNA might be contaminated; or, as a method to monitor food authenticity. Certainly, were these peptide markers expanded for more mammals, this method would make a valuable addition to solving problems concerning identity.

It may be noted that in some legal killing of wild animals for subsistence may be legal but killing for commercial purposes shall not be legal. Thus, scientists, in order to know the answer of question “why animal died?” or “how the animal died?” focus on cause or manner of death or who did it, to find out the killer’s intent (A. Neme *et al*, 2009).

3. LEGAL ASPECT:

It is submitted that protection and preservation of wildlife including all flora and fauna found in the forest is the foremost task of Environmental Laws. Obviously, any person who violates wildlife in any way deserve an adequate punishment according to the provisions of the specific given law, if any, else he must be brought to justice under national criminal or civil law, provided that such laws covering such an act as wrongs against wildlife.

India, as we all know it well, is a country always have rich flora and fauna, yet, in the current time huge loss of fauna occurred because of uncontrolled crime against wild rampantly taken place all around the country. Now government of India has established “Wildlife Crime Control Bureau” having five regional offices in Delhi, Chennai, Mumbai, Kolkatta and Jabalpur. Under section 38(Z) of the Wildlife (Protection) Act, 1972, it is mandated to collect and collate the information against organized wildlife crimes and share the informations with the States so that the offenders may be apprehended in time.

Further, as everyone knows that Law is dynamic and not static and therefore, as society evolves, law has to be keeping in consonance with the changing social order. Law is the instrument of societal change and the judiciary has the responsibility of interpreting the law for the Greater good (Bentham, 2000). Therefore, it is clear that the judicial mind must stay in touch with fast developments and keep ahead in taking the steps for the advancement

of humanity. To combat organized environmental crimes, its detection, investigation and prevention methods have to be employed synchronously (Nathuni Yadav v. State of Bihar) so that they all together yield effective results. If criminals are using new technology, whether scientific or not, in committing the crimes, the enforcement agencies have to be used to the new techniques, as above-mentioned, in solving such crimes. If the enforcement agencies do not use these new technologies for solving such complicated the crimes, it would be very difficult to detect the perpetrators of such crimes. Therefore, in the context of the changing organized modern criminal who are taking shelters behind and making full use of new sophisticated technologies. Krishna Iyyer J. Remarked, "the courts self-criminate themselves if they keep the gates partly open for culprit to flee the justice under the guise of interpretative enlargement of golden rule of criminal jurisprudence (Nandini Sathpathy v. P.L. Dani & Anr). As Anjum Parvez *et al.*, (2020) emphasis that modern technology, with its rapid growth and development, has quickly made an inroad in every aspect of human life, and many would agree that task of solving the crime with the aid of technology is now not an exception, it is submitted that same is equally true about conservation and protection of wild animals where technology can play a vital role.

4. DISCUSSION

Identity of wild animals for the purpose of ensuring their good health and nutrition is essential which can be ascertained by applying scientific methods of identification. Scientific methods of identification of wild animals have been extensively used in Europe, and results are very effective although for applying any scientific method, only negative aspect emerge that is some pain for certain small period of time may have to be bear by that particular animal yet in the larger interest, it is submitted, it is ignorable. Forensic Osteology is another important technique where on the basis of remains of a dead animal identity of that animal can be established.

However, shaving or cutting the fur or hairs of animal is one of the good techniques of identification, but it works only for short term as the removed fur or hair will again grow in short period of time. It is indeed good for rodents, but useless for the carnivorous animals. Felt Tip Marker technique is better, but only on small animals like birds and rodents (Hankenson *et al.*, 2008). Subcutaneous Injection of Ink as a permanent mark of identification ensures permanent mark o animal skin (Leclerq and Reozenfeld, 2001), but sometimes, the ink cause reaction which may be fatal in some cases. Same is true about making a Tattoo mark. Ear Tagging has been proved effective in tracing out the animals from bulk without coming into the contact

with them (Hawkins *et al.*, 2004).

Inserting the Microchip Transponder in the body of an animal needs a small surgical operation of the animal in which such chip is to be fixed, but, for this purpose scientists need to make that animal tranquilized. Some sort of pain will be inevitable for that animal consequent to such surgical operation which he cannot communicate to humans, but that is for the well being of that animal. All these techniques are of great use when the animal is alive and there will be vigil on his conditions of nutrition and habitat. But even if animal has been hunted down by the hunters, law needs to get the offenders nabbed and ensure punishment for them because justice demands adequate punishment for offenders in order to discourage them and others from repeating the crimes against wild animals. Stable isotopes present on animal remains pointing out the traces of poison in the carcass, are of great relevance before the court of law for establishing the cause of death of that animal. Genus-Specific Peptide Markers have been found very effective in ascertaining the specie of a deceased animal.

But, in present day situations, D.N.A. Profiling of animals have been becoming of great significance as it is emerging as a reliable method of identification (Parvez, Anjum and Sandhya Verma, 2018). In the opinion of authors, D.N.A. Identification is the best method so far available to the Wild life authorities and indeed the most reliable. D.N.A. Sequencing and Automated Multiplex Sequencing effectively determine the nucleic acid sequence. (Parvez Anjum *et al.*, 2020).

No doubt, the blend of law and science may be proved revolutionary in conservation of forest resources provided that sincerity on the part of law enforcement agencies is shown. Further, for forensic methods we need to establish many new forensic laboratories exclusively for animal welfare, so that crimes against animals can be investigated in effective manner.

5. CONCLUSION

At present forensic science is playing pivotal role in criminal justice system, especially in the identification of victims and accused. With the help of forensic science it becomes possible to solve the crime and detect the criminal. It is really very helpful to criminal justice system. As already mentioned above, from the point of view of survival and environment, all societies are undergoing through drastic social changes all around the world, at a very rapid pace as environmental awareness evoked in them as result of intense use of social media platforms. Similarly, India has also changed from a colonial subject race to a democratic republic. Sizeable industrial complex has sprung up. The

transport facilities have been revolutionized. There is a growing shift from a rural society to an urban one. All these alterations have made the old techniques of criminal investigation obsolete. In the British days the police was so much feared that once it had laid its hands upon an individual, he would be compelled to 'confess' to any crime, he may not have even known. The fear is vanishing now. The use of 'third degree' techniques used in those days does not find favor with the new generation of police officers and judges.

The field of activities of the criminal is widening day by day at a terrific rate. Formerly, the criminals were usually local, now we find that national or international criminal is a common phenomenon. Smuggling, drug trafficking, financial frauds and forgeries offer fertile and ever expanding fields. All this pose a serious challenge before the law enforcement agencies as well as before the Courts. Role of scientific experts in criminal investigations become vital now as most of the crimes in modern times need thorough and complete investigation beyond any shadow of doubt. Thus, use of modern scientific methods in investigation and collection of evidence in crimes against wildlife is a well-come step.

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