TECHNICAL SESSION – II
CONSERVATION THREATS

DIFFUSE POLLUTANTS OTHER THAN NSAIDS–ANY POTENTIAL CONCERN FOR VULTURES IN INDIA?

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ABSTRACT

While the reason for the population decline in vultures in Southeast Asia is proved beyond doubt, we kept tract of a few potential diffuse pollutants, namely organochlorine pesticides, polychlorinated biphenyls, polycyclic aromatic hydrocarbons and heavy metals with the main aim to check if they did contribute to the calamitous population reduction over the years in India. Samples of tissues from four species of vultures, namely *Gyps bengalensis, Gyps fulvus, Gyps himalayensis and Neophron percnopterus* were collected on opportunistic basis from Gujarat, Tamil Nadu, Assam, Delhi and Punjab between 1999 and 2015. Samples were brought over ice to the laboratory at SACON, Coimbatore and processed adopting standard protocols, and analyzed through Atomic Absorption Spectrometer, Gas and Liquid chromatography with appropriate detectors. While varying concentrations of the referred chemicals were detected in all the species of vultures, none of the birds had levels indicative of poisoning. Since no historical data on the residue levels of any of the group of chemicals tested is available in vultures in India, data generated in this study can serve as guidelines for future research. In the light of the information available in the literature on vultures and other species of birds in India and elsewhere in the world, it can be inferred that the chemicals studied may lead to impairment of reproduction, behavioral and neurological functions, and suppression of immunity if the exposure levels increase or even remain the same over a period of time. With particular reference to the level of *p,p'* DDE recorded in the eggs, we need to be watchful owing to its persistence and potentiality to create eggshell thinning, hatching failure and impair reproduction. Unfortunately, we still have fresh input of DDT into the environment. Considering the precarious position of vultures in India, continuous monitoring of the levels of select contaminants and their effects on vultures is inevitable. It is further recommended that attention may be paid, particularly in breeding areas across their distribution range in the country.

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IMPACT OF DICLOFENAC, OTHER NSAIDS AND INDIRECT POISONING ON VULTURES

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This article deals with pathophysiology of diclofenac, other NSAIDs and indirect poisoning on vultures. Vultures are social birds, scavengers, sanitary workers feed on dead and decaying materials in the forest area. They play an important role in keeping the ecosystem clean and healthy. It is observed that during 1900 there were thousands of vultures present all over India. In southern parts of India, vultures were scattered in Tamilnadu, Kerala and Karnataka states. Four species of vultures were found all over Tamilnadu, namely Oriental White-backed vulture (OWBV), Indian (Long-billed) vulture (LBV), Red-headed vulture (RHV) and Egyptian vulture. From the records of bird watchers, vultures were often sighted as leather tanneries in Chrompet Dindugal. In Vallam village, outskirts of Tanjore and also seen in Tirunelveli, Ramnad, Madurai, Sivangangai, Coimbatore etc.

Moyar valley is located in Nilgiri Biosphere Reserve, it is a part of Western and Eastern Ghats and moyar valley is considered as a biodiversity hotspot. Perennial and semi perennial rivers drain into Moyar river. Along the basin Mudumalai, Bandipur and Sathyamangalam Tiger reserves are located. It is a dry deciduous forest and largely forested by dry thorns, suitable nesting and roosting habitat including cliff are found along Moyar valley. Diclofenac usage is remarkably less due to the presence of committed veterinarians. In India, decline of vulture population was first observed during 1980 at Keoladeo Ghana National Park, Rajasthan. At the end of 20th century the number of vulture population was drastically reduced.

Before the period of decline, the neck drooping phenomenon was observed in Eurasian vultures. The birds exhibited this behavior for over several weeks before falling from tress. This was an important behavior was monitored and recorded more frequently in higher proportions of weak and sick birds. Initial hypotheses for declining of vulture population were non availability of dead livestock and epidemic diseases. Later, from the investigation study carried out by researchers working abroad had found visceral gout was reasoned for 85% of dead vultures. It is a condition in which uric acid gets accumulated within tissues and on the surfaces of internal organs. The cause of death is due to renal failure as a result of metabolic, infectious or toxic disease. Histopathology revealed that there was severe renal tubule damage, indicating a toxic cause. No conclusive report of any epidemic disease was found as reason for declining vulture population. Though toxic is major cause, there are several causes affecting vulture population in minor level. Persecution by cattle herders through poisoning, Carcass unavailability and Habitat degradation.

In India, White revolution came into existence from late 1970 to 1996. It was divided into 3 phases. 1st phase was implemented from 1970 to 1980, 2nd phase was from 1980 to 1985 and 3rd phase was from 1985 to 1996. As a result, more high yielding exotic cattle breeds such as Jersey, Holstein replacing our native ones which resulted in decline of Indian breeds. Though exotic cattle were high yielding, they were more susceptible to diseases. In India, the introduction of diclofenac started from late 1980s to treat the livestock especially and at the same period white revolution was in a full swing all over the country. In non forest areas it was a common practice to dispose the dead livestock near to graveyard, unused open places and dump yard. Government policies and court orders discouraged open disposal of dead livestock. Despite the orders on dead livestock treated with diclofenac was also disposed in open places and vultures continued to feast on them. In the last 10 years of 20th century scores of vultures died. Several studies were conducted to identify the reason for decline of vulture population. Researchers found similarity in death pattern and postmortem lesions.

Diclofenac is a Non-steroidal anti-inflammatory drug (NSAIDs), which has been used since 1990s in Indian subcontinent for treatment of inflammation and pain in domesticated ungulates. The vultures would possibly scavenge on carcasses of dead livestock treated with diclofenac, death occurred within a few days as a result of severe kidney damage and visceral gout were observed in postmortem. It is finalized that vultures are highly susceptible to diclofenac.

According to the Nilgirs and surrounding forest areas, vulture population highly depends on tiger carcasses. When tiger population decreases the vulture population also decreased. Tigers are providing food for vultures because they prefers large herbivores like sambar and gaur and cannot always hide them completely. Leopard hide their prey on tree tops and wild dogs devour them completely. Tigers vanished from our country mostly due to retaliatory killing or revengeful killing/attitude over the cattle kills in the forest areas by people using poison than by shooting, snaring etc. The poisoning of tigers is also an important cause for declining of vulture population in these areas. Generalization of cause may not be completely correct. Landscape problems and localized issues, traditional and cultural factors also play an important role in increased mortality rate of vultures. From my personal observation of 25 years in the Forest Department, revival of tiger population along with vulture population in Moyar river belt is another indication of relationship. The protection measures given by the Forest Department immensely helped for the revival of

population slowly and steadily. The conservation programs are recommended by workshops which demanded for phasing out veterinary use of diclofenac. There were many workshops held in different parts of country are as follows. International workshop at Kathmandu, Nepal viz. in Parwanoo in February 2004, Haryana in February 2004, National Workshop at New Delhi in April 2004, Second Meeting of the National Board for Wildlife (NBWL) on 17th March 2005, International Conference on Vulture Conservation at New Delhi from 31st January 2006 to 1st February 2006. Meloxicam was found to be safe at 2.5 x LD50 of diclofenac, it has been concluded that at a dose rate equal to or more than amount of scavenging birds could consume as drug residue though feeding on animal carcass may be considered safe.

VULTURES AND NSAID'S

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ABSTRACT

Gyps vultures in the Indian Subcontinent have been undergoing a major decline in population since the late 1990's. It has been empathetically proven that the major cause of the vulture decline, is the use of the veterinary NSAID diclofenac. Diclofenac causes damage to the kidneys and in turn results in an increase in the uric acid levels in the blood of vultures, resulting in mortality due to gout. Diclofenac happened to enter the food chain of vultures due to the long elimination time (half-life) it takes to be totally excreted from the body.Hence it is important to note that we must ensure that the drugs injected in livestock are not only safe for the animals in which they are being injected but also safe for the animals and birds that would be scavenging on their carcasses should they die. Therefore, other drugs used in livestock should also be tested for their safety on the scavenging species. Other NSAIDS like aceclofenac, ketoprofen, carprofen, flunixin and nimesulide have been found to be toxic or potentially toxic for vultures while the safety of other NSAID's like aspirin, phenylbutazone, paracetamol, etc. needs to be tested. It is important to assess the situation and educate the veterinarians about the harmful effect of these NSAID's on vultures and ensure that the veterinarians in turn dissipate the knowledge to the farmers. It is also imperative to test other NSAID's and other routinely used drugs in cattle for safety to vultures and other scavengers. This will ensure a safe environment for the vultures in the Indian subcontinent.

Key words: Gyps, vultures, NSAID, diclofenac, ketoprofen, aceclofenac.

Introduction

The vulture decline in the Indian sub-continent was first reported from the Keoladeo National Park in 1999 by Dr Vibhu Prakash (Prakash, 1999). Scientists from all over the world worked and rallied to find the cause for the decline. Numerous causes such as infectious disease, persecution, food shortage and environmental contaminants were considered to be the reasons behind the decline (Pain *et al.,* 2003). After many months of research and testing, Dr Lindsey Oaks and his team discovered that the cause of the decline was the veterinary drug formulation of Diclofenac, which had found its way into the food chain of the birds (Oaks *et al,* 2004) due to its long half life period. This finding therefore, conveys a strong implication on the safety or potential toxicity of human and veterinary drugs in scavenging birds.

In the past, before the discovery and administration of diclofenac, NSAIDs (Non-Steroidal Anti-Inflammatory Drugs) like Paracetamol, Phenylbutazone, Analgin (dipyrone), etc., and their combinations were being used for the treatment of inflammatory symptoms. However, with the phasing out of Analgin, (due to its toxic side-effects), use of diclofenac became popular due to its efficacy, availability and low cost. The potential ecologically toxic effects of human and veterinary pharmaceuticals pose a major concern especially now after Dr Lindsey's discovery.

Current Scenario

After the ban on the use of veterinary Diclofenac (GOI, 2008), other NSAID compounds like aceclofenac, flunixin, ketoprofen, carprofen, nimesulide and meloxicam are being administered in livestock. In order to provide a safe alternative to diclofenac, safety testing in vultures was carried out for other anti-inflammatory compounds. During the safety trials, Meloxicam was found to be safe for vultures (Swan *et al.*, 2006; Swarup *et al.*, 2007) however Aceclofenac was not found to be safe as it metabolized to diclofenac in vivo (Sharma, 2012; Galligan *et al.,* 2016). Ketoprofen too was tested to check for toxicity to scavenging vulture and was deemed toxic (Naidoo *et al.,* 2010 a,b). Toxicity trials were also conducted for Carprofen, Flunixin and Phenylbutazone and the drugs were deemed unsafe as administration of the drug killed a few but not all the vultures tested in the trial (Cuthbert *et al.,* 2007; Ramzan *et al.,* 2012; Zorilla *et al.,* 2014; Fourie *et al.,* 2015; Naidoo *et al.,* 2018). Safety and toxicity studies for Nimesulide are yet to be carried out however, based on empirical data it is currently deemed as unsafe for vultures. Aspirin, Dipyrone (Analgin), Ibuprofen, Phenylbutazone, Piroxicam, Mefenamic acid, Naproxen and Tolfenamic acid are all NSAIDs of unknown toxicity to vultures. Safety testing on Gyps vultures is the necessary direct evidence that is needed to determine whether a certain NSAID is toxic or non-toxic to vultures. It is not possible to predict whether these NSAIDs are toxic by simply comparing their structure or classification to that of actually toxic NSAIDs and studies need to be carried out in vivo.

Discussion

When new drugs are discovered, they are tested for their efficacy and safety. Their median lethal dose is calculated and the dose ranges at which it is safe in the target species is determined. It is perhaps time that pharmaceutical manufacturers also consider determining the potential toxic effect that a drug or compound could or will have on the environment. Reports of secondary poisoning of scavenging birds by organophosphates, other pesticides as well as barbiturates (Henny *et al.,* 1985; Langelier, 1993) are becoming more frequent. The world almost lost 3 species of Gyps vultures and three other species of vultures are now endangered only because we did not have the foresight to carry out an ecological toxicity trial for drugs that enter and

become part of an ecological food chain. The need of the hour therefore, is to test and provide for the potential ecologically toxic effect for all drugs used in livestock and humans, be they antibiotics, sedatives, NSAIDs or anthelmintics.

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USE OF THE NSAID DICLOFENAC IN THE RURAL VETERINARY PRACTICE

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ABSTRACT

The use of Diclofenac (NSAID) in the veterinary practice resulted in the catastrophic declines of *Gyps* Vultures. Being a scavenger in habit, vultures preys upon the carcasses of livestock died soon after the treatment with Diclofenac and they dies within few days. The residues of diclofenac in the muscles of livestock carcass consumed by vultures causes kidney damage, increased serum uric acid concentration, visceral gout and death. The same result accurs with other drugs like carprofen, flunixin, Meglumine, Phenylbutazone, Aspirin, Salicylate or corboxilic acid derivatives, Propionic acid (Ibuprofen, Naproxan) Fenamates, Oxicams. Even after the ban of Diclofenac by the Government of India the related harmful drugs are still available in the market in various forms produced by different companies. In the rural area the unqualified para veterinarians are using the NSAIDs available for veterinary use. If it is not available they are going for human preprations of diclofenac for their use. The harmless anti-inflammatory drugs available in the market. But the above people are reluctant to use the same drugs. The presence of the vultures in the ecosystem and its effects on human and other wild animals are highly important. Safe anti-inflammatory, analgesic, antipyretic combination drugs can be used instead of NSAIDs.

Key Words: NSAID, Rural, Practise, Diclofenac, Tamil Nadu

Introduction

The term NSAID describe compounds that are not steroidal and suppress Infalammation. Inflammation occurs in the vascularized tissue in the body. The signs are redness, heat, swelling, pain and loss of function. Vasoconstriction occurs first and the predominant cells infiltrating the area of inflammation are polymorphoneuclear leucocytes (PMN). The accumulation of lysed cells commonly refered as pus.

NSAIDS

Aspirin: it's the earliest components of herbal therapy and it's the progenetor of NSAID

NSAID: Broadly classified into

a. Salicylate or carboxylic acid derivatives includes indole (indomethacin)
b. Propionic acid(Ibuprofen and naproxan)
c. Fenamates (meclofenamic acid)
d. Oxicams (pyroxicam) or pyrozolones or enolic acids(Phenylbutazone and dipyrone)

NSAIDs are well absorbed after oral and parentral administrations.

Bioavoilability varies between animals unbound drug is distributed to extra cellular fluid. Small portion of pharmacologically active drug reaches periferal tissues.

Adverse reactions in animals

1. Gastro intestinal : a) Gastroduodenal erosion b) Ulceration C)mucus secretion d) epethelization and blood flow.
2. Haematopoietic a)able to impair Platelet activity.
3. Renal : Analgesic nephropathy in human being but does not occur frequantly in domestic animals

Veterinary use of NSAID diclofenac in south asia has resulted in catostropic decline in the population of three vulture species of genus Gyps since early as 1990. The loss of tens of millions of vultures over the last decade has had major ecological consequances across the Indian subcontinent that pose a potential threat to human health. These three vulture species under genus Gyps are 1) oriental white backed (Gyps Bengalensis 2) Long billed (Gyps Indicus) 3) Slender billed (Gyps tenuirostris) are now at high risk of global extinction declared by IUCN in 2004

Vultures the scavenging bird dies within days when they prey over the carcasses of livestock's treated with diclofenac (NSAID) shortly before death. The residues of diclofenac found in the flesh of Livestocks carcasses caused the kidney damage, increased serum uric acid concentration, viseral gout and death in vultures within days of consumption. Consumption of one kg of meat from an animal that died shortly after a veterinary course of the NSAID could be exposed to doses close to or within the range of doses 1-5 mgms per kg^{-1} cause mortality.Ban announcements from Indian government come on the veterinary use of diclofenac by September 2005.Apart from diclofenac other drugs like carprofen, flunixin, meglumine, ibuprofen, phenylbutozone also cause mortality.The NSAID still available in markets are Nimesulide & paracetamol in the name OXALGIN and Rely NP bolus and 100 ml vial Nemovet in 15,50 and 90 ml vials. Safe antiinflammatory analgesic, antipyretic drugs are available like meloxicam, tolfenamic acid. We can use these drugs without any side effects to lives tocks and will not affects vulture species also in turn.

Because there is no awareness among the rural unqualified persons going for animal's treatment over the adverse effects of diclofenac, there is chances for usage of this drug is possible. Even though high court turns down plea of pharmaceuticals from Haryana and Madhya Pradesh that the multiple dose packs of diclofenac for human use would be economical. But single dose pack containing a maximum of 3ml in each vial available now. In the absence of veterinary diclofenac and multidose human pack there is chance for going to single dose human diclofenac drug.

In my service in forest department in five years from 2000 to 2005 and also in the fringe areas of forest in animal husbandry department I did not come across any postmortem over vultures death confirmed for diclofenac.

In many places populations of feral dogs (canis familiaris) have benefited from the disappearance of Gyps vultures as the main scavenger of wild and domestic ungulate carcasses. Associated with the rise in dogs numbers is an increased risk of human cases of rabies. If rat (Rattus Species) populations also increase at carcass dumps in and near settlements the risk of transmission of diseases including bubonic plague to humans may also increase. Vultures also helped to control livestock diseases such as brucellosis, tuberculosis, and anthrax by disposing of infected carcasses. . Zoroastrian pavsi community who traditionally use vultures to dispose of human corpses. It's absolutely necessary to screen the live stocks deaths wether inside or fringe areas of forests suspected for any type of poisoning must includes diclofenac and other NSAIDS also.

The following measures can be taken to save the vulture species.

1. Awareness to be created in depth among veterinarians, pharmacysts, medical store people and general public regarding the ill effect of NSAID.
2. Unqualified persons going to treat lives tocks to be curtained with effective rules.
3. Appropriate advice can be made to government to stop production of NSAID in veterinary use.
4. Awareness to be created among general public in the proper disposal of car cases of live stocks in the fringe area of forests.
5. Safe anti inflammatory, analgesic, drugs can be used in veterinary practice instead of NSAID.

SECONDARY PHORATE POISONING OF LARGE CARNIVORES IN INDIA

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ABSTRACT

India, with its huge human population and fragmented wildlife habitat, is plagued with human–animal conflicts. In conflict areas, large carnivores are often primary targets for malicious poisoning. The effects of certain poisons do not stop with the target animal but also affects other species of wildlife in the form of secondary poisoning. This paper describes incidences of secondary poisoning of a tiger (*Panthera tigris*) and a black panther (*melanistic Panthera pardus*) in the Nilgiri Biosphere Reserve. Wild boars (*Sus scrofa*), which are considered pests in horticultural plantations, were the primary targets in both cases and were poisoned using phorate, a highly toxic organophosphorus compound. Tigers and leopards hold significant position in the upper most trophic level of the ecological pyramid and are grouped in schedule I of the Wildlife Protection Act of India. The tiger, as a species, is currently waging a grim battle of survival in the wild. The world over, leopard populations are also dwindling. The implications of the death of these endangered apex predators due to the increase in population of the ubiquitous wild boars are analyzed. The merits of introducing a policy of selective culling of wild boars in conflict areas are discussed.

Key Words:

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Secondary phorate poisoning of large carnivores in India

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Abstract India, with its huge human population and fragmented wildlife habitat, is plagued with human–animal conflicts. In conflict areas, large carnivores are often primary targets for malicious poisoning. The effects of certain poisons do not stop with the target animal but also affects other species of wildlife in the form of secondary poisoning. This paper describes incidences of secondary poisoning of a tiger (*Panthera tigris*) and a black panther (melanistic *Panthera pardus*) in the Nilgiri Biosphere Reserve. Wild boars (*Sus scrofa*), which are considered pests in horticultural plantations, were the primary targets in both cases and were poisoned using phorate, a highly toxic organophosphorus compound. Tigers and leopards hold significant position in the upper most trophic level of the ecological pyramid and are grouped in schedule I of the Wildlife Protection Act of India. The tiger, as a species, is currently waging a grim battle of survival in the wild. The world over, leopard populations are also dwindling. The implications of the death of these endangered apex predators due to the increase in population of the ubiquitous wild boars are analysed. The merits of introducing a policy of selective culling of wild boars in conflict areas are discussed.

Keywords Secondary poisoning · OPC · Phorate · Tiger · Leopard · Wild boar

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Introduction

The tiger (*Panthera tigris*), the largest living feline on earth, is waging a battle of survival (Chundawat et al. 2008), with <1,500 animals alive in the wild in India. The reduction in the population of this apex predator from the niches in India has served as a blessing in disguise for the leopard (*Panthera pardus*), which is now emerging as the primary predator in many of the sanctuaries in India. However, the status of leopards the world over has been revised to 'Near Threatened' (Henschel et al. 2008) from 'Least Concern', clearly pointing to a reduction in their wild population. Habitat fragmentation has brought these versatile predators into a direct conflict situation with humans.

These large carnivores are usually primary targets of intentional poisoning, in response to cattle lifting and man eating. They also become victims of secondary poisoning due to their occasional scavenging habits. The present paper reports incidences of death of a tiger and a black panther (melanistic variant of *P. pardus*) due to secondary poisoning. These animals had consumed meat of wild boars (*Sus scrofa*) killed using phorate, a granular organophosphorus compound (OPC) pesticide, in two separate incidents at Nilgiri Biosphere Reserve, Tamil Nadu, India. The necessity to document these studies was felt, considering the importance of these species of carnivores in terms of conservation as well as their part in ecology and a dearth of literature on such incidents.

Materials and methods

In January 2008, intact carcasses of Indian wild boars (a nursing sow and two piglets) and an Indian mongoose (*Herpestes javanicus*) were found in a tea estate, near a banana plantation located in Gudalur range, Nilgiri Biosphere Reserve. An empty plastic insecticide cover, inscribed '10% Phorate', was retrieved from a bush nearby. Necropsy was conducted on all four carcasses by the local veterinarian. Three days later, the Forest Veterinary Assistant Surgeon, Mudumalai Tiger Reserve (senior author), was informed of the presence of a carcass of a male tiger in the same tea estate within a distance of 300 m from the wild boar carcass. A detailed necropsy was conducted on the tiger carcass. Composite sample (250 g) containing stomach and intestinal loop with contents and portions of liver were collected in sealed containers from the tiger carcass in saturated sodium chloride solution as preservative and sent along with plain preservative as control to the Regional Forensic Science Laboratory (RFSL), Government of Tamil Nadu, Coimbatore, for toxicological analyses.

The second incident happened in June 2009 in Kannerimookhu, Kuntha range, also in the Nilgiri Biosphere Reserve. This involved the death of a melanistic leopard whose carcass was also found in a tea estate adjoining horticultural fields with crops like carrot and potato. An elaborate necropsy was conducted by the above stated. About 100 g each of stomach contents, intestinal loop with contents, liver, kidney, lung, and heart was collected separately in 400 ml of saturated sodium chloride solution as described above and sent for toxicological analyses.

The samples were analysed using thin-layer chromatography followed by gas chromatography–mass spectrophotometry at RFSL.

Results and discussion

Circumstantial evidence, necropsy lesions and laboratory confirmation revealed that the tiger and leopard had died due to secondary poisoning with OPC (phorate).

The report on the necropsy findings on the wild boar carcass as described by the local veterinarian is as follows: The wild boar sow was found to have three functional udders, whilst only two piglets were found dead in the area. Fresh, undigested, unripened bananas and banana tubers were found in the stomachs of wild boar carcasses. Other signs of toxic lesions like pulmonary edema, dilated and fluid-filled intestinal tract with haemorrhages and degenerative and necrotic changes in kidney and liver were observed in the wild boars. Similar findings were recorded in the mongoose carcass also.

The carcass of the tiger, which was a young male of about 4 years, was in a putrefied state and was infested with maggots, the largest measuring about 1.5 cm long. Necropsy revealed the presence of 4–5 kg of undigested meat in the stomach. Closer examination of the stomach contents revealed the presence of pieces of skin with typical hair, as well as portions of hooves of a wild boar piglet. The gastric mucosa was congested. Slight pulmonary oedema and frothy discharges in trachea and bronchial trees were noticed. The composite sample from tiger was found to contain 3.9 g% of insecticide equivalent to phorate.

Enquiries revealed that the workers of the plantation had used phorate-impregnated bananas to get rid of wild boars, which had caused immense damage to their banana plantation. Only two of the poisoned piglets were found in the vicinity of the dam. It is known that the number of functional teats in a wild boar sow corresponds to the number of live, suckling piglets (Fernández-Llario and Mateos-Quesada 2005). It can be surmised that the tiger had predated or scavenged on the carcass of one of the poisoned piglets and died of secondary OPC poisoning. The circumstantial evidence was corroborated by laboratory results, which showed the presence of OPC in the composite sample, confirming death due to OPC poisoning. The recovery of empty phorate cover from the vicinity of the carcasses of wild boar and the history of poisoning incriminates phorate as the specific OPC involved in this case.

The leopard carcass revealed a picture of generalized congestion and haemorrhage. The visible mucous membranes were brick red in colour and there was a string of mucoid blood from the nostrils. Carrion blowfly larvae were found in the buccal cavity. Rigor mortis was present. Necropsy revealed that the peritoneal cavity contained about 1 l of serosanguinous fluid (Fig. 1a). Trachea was haemorrhagic (Fig. 1b). The heart showed pericardial effusion with the pericardial sac being filled with about 100 ml of blood-tinged fluid (Fig. 1c). There were petechiae on the epicardium and the endocardium was severely congested (Fig. 1d). There was pulmonary oedema and generalized haemorrhage of all lobes of lungs (Fig. 1e). About 1 kg of darkish, partly digested content was found in the stomach (Fig. 1f). Whilst no distinct body parts were identifiable in the gastric content, numerous stiff hair and bristles, which were indistinguishable from those of wild boars, were found. The kidney showed severe subcapsular haemorrhage (Fig. 1g) with severe congestion of the cortex (Fig. 1h) and cortico-medullary junction (Fig. 1i).

In the case of the leopard, no circumstantial evidence could be retrieved from the region. However, the presence of wild boar flesh in the stomach and type of lesions noticed instigated a suspicion of poisoning. The RFSL confirmed the presence of phorate in stomach and intestinal content (0.78 g%), liver (11.26 g%) and kidney (4.55 g%) of the leopard, whilst the heart and lung tested negative.

Large carnivores usually remain as target species for primary poisoning and are usually baited using carcasses

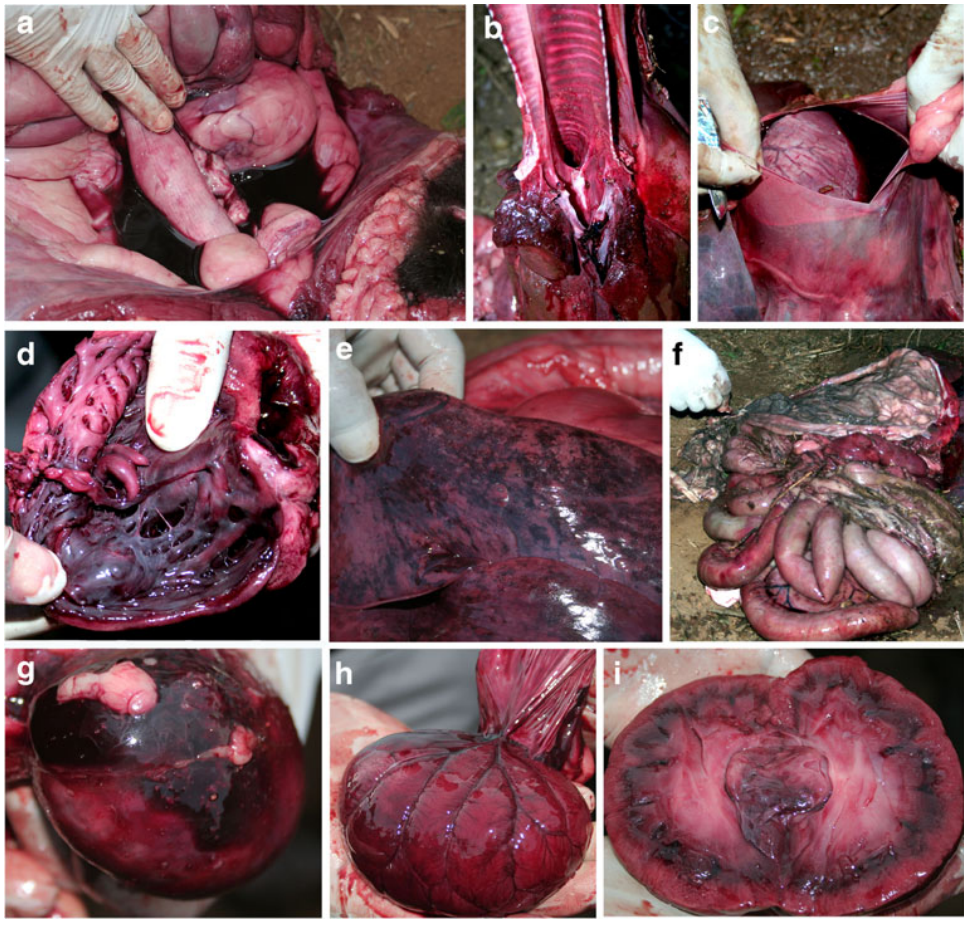

Fig. 1 Necropsy lesions of the leopard: **a** Peritoneal cavity containing serosanguinous exudate, with generalized congestion of all visceral organs. **b** Severe congestion of trachea. **c** Congestion of pericardium with the pericardial sac containing about 100 ml of sanguinous fluid. Congestion of the epicardium is also noticed. **d** Congestion and petechiae of endocardium. **e** Lungs showing generalized, diffuse, patchy haemorrhages. **f** Stomach containing partly digested content. The intestinal mucosa shows patchy congestion and engorgement of mesenteric blood vessels. **g** Severe subcapsular haemorrhage of kidneys. **h** Congestion of the cortical surfaces and capsule of the kidneys. **i** Cut section of kidney showing congestion of the cortico-medullary junction

laced with poison. Venkataramanan et al. (2008) reported an incident of poisoning of leopard in the same region by baiting with cattle carcass laced with carbofuran. Several lions had succumbed to carbofuran in Kenya and other parts of Africa (Given 2007). Scavengers and carrion eaters like vultures, crows, Indian magpie, black kite, Brahminy kite and hyena are the most common non-target species that bear the brunt of secondary poisoning (Wobeser et al. 2004; Martinez-Haro et al. 2008). The two incidents reported herein is a testimony to the fact that large carnivores like the tiger and leopard, which usually hunt live prey, also can fall victim to secondary poisoning due to their occasional scavenging habits.

In India, there are reports involving poisoning of wildlife with other OPC compounds like phosphamidon, malathion and monocrotophos (Gureja et al. 2002; Arora 2003; Pain et al. 2004). However, a search of literature reveals that use of phorate in incidences of poisoning of wild animals in general and large carnivores in particular has not been reported

The tiger carcass was putrefied, with the presence of fully developed maggots, whilst larvae were noticed in the buccal cavity of the leopard carcass, which was reasonably fresh. Gunatilake and Goff (1989) demonstrated the presence of OPC compounds in larvae of *Chrysomya megacephala* and *Chrysomya rufifacies* from a putrefied human carcass proven to have died due to malathion poisoning. The findings in the present cases also support the theory that maggots can develop in carcasses of animals that die due to insecticide poisoning.

The animals affected in these two incidents, the tiger and the leopard, fall under the 'Endangered' and 'Near Threatened' categories, respectively. Even though the bait was for the wild boar, classified under the 'Least Concern' category of the IUCN and protected under Schedule III of the Wildlife Protection Act of India 1972 (WPA), it has claimed the lives of two important wildlife species listed under schedule I of the Act. The population of wild boar has been kept under check within the protected areas (PA) by predators, whilst it has increased exponentially in plantations outside the PA due to restrictions in hunting, coupled with reduced pressure from predators. As a result, this animal has emerged as a major threat of most of the horticultural crops and has earned undue notoriety among the farmers. The affected farmers try to get rid of them by illegal means using explosives hidden in food ('flour balls' which explode when bitten, leading to damage of the jaws and a painful lingering death) and poisoning. Poisoning is usually through baits like bananas laced with poison, as

established in the case of the tiger. The poisoned boars can potentially act as a source of secondary poisoning to other wildlife, as seen in the two incidents.

The practice of selective culling of wild animals, to prevent their population reaching nuisance levels, has been followed in many countries. In Spain, selective killing of wild boars, called as Monteria, is carried out seasonally to keep the population in check (Fernández-Llario and Mateos-Quesada 2005). The two instances of secondary poisoning discussed highlight the necessity of a programme for controlling wild boars to be introduced in India also. Presently, the Government of Tamil Nadu is considering downgrading the status of wild boar from schedule III to V, which will permit farmers to kill the animals when found raiding their farm lands (Anonymous 2009). Otherwise, such setbacks can act to dampen the effort of preserving the biodiversity of India.

Acknowledgements We thank Dr. Rajashekhar, Veterinarian, Aavin, Ooty, for communicating the details of the necropsy of the wild boars and mongoose. Thanks are also due to Dr. N.V.K. Ashraf, Director, Wild Rescue, Wildlife Trust of India, for his critical analysis of the manuscript.

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POST MORTEM ANALYSIS OF WHITE-RUMPED VULTURES IN MUDUMALAI TIGER RESERVE

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Short Note

The Nilgiri Biosphere Reserve which is the first biosphere reserves in India. It is located in the confluence of Western and Eastern Ghats which has an incredibly rich diversity of fauna and flora is one of the mega biodiversity areas of the nation. Further it is being the most important landscape for tiger, leopard, elephant, bear, wild dog etc. Besides the Nilgiri biosphere reserve protects many avian species, especially Mudumalai Tiger Reserve core and buffer area conservation acts as a heritage for vultures. Vultures are very important in forest conservation. Vultures are largest avian scavengers. By their feeding action they keep the ecosystem clean and healthy. Vultures are controlling many pathogens which are growing rapidly in the rotten meat. The vulture population is almost going to extinct but it is reviving presently. In this juncture death of vulture in Moyar valley is of great concern.

On 24.12.2014 seven vultures were found dead by the forest staff during their routine patrolling at Masinagudi range of Mudumalai Tiger Reserve with regurgitated symptoms among the seven one was alive which was struggling for life at the same day one wild dog carcass was also found nearby. Wildlife veterinary team from Theppakadu, Mudumalai Tiger Reserve, rushed to this spot and rescued the wild bird and necessary treatment was given. Despite of all efforts, the vultures were died. The dead birds and the wild dog were undergone to detailed post-mortem was conducted by the team of Veterinarians with the presence of forest staff and biologists. Biological samples were collected and sent to the forensic and pathological laboratories. After the post-mortem necessary samples were collected and all the carcasses of vultures, wild dog were completely burned. The samples were collected in sterile containers and preserved in saturated salt solution and sent to the Regional Forensic Science Laboratory by following standard procedures. The results were obtained from the concerned laboratory and found that ***Organophosphrous and urea*** poisoning was reasoned for the above deaths. The necropsy found that no lesions in the joint cavity, no drug residues at visceral organs revealed by forensic lab.

A week after, one buffalo carcass was found where the vultures were died. Flesh samples of the buffalo carcass was examined, collected and sent to the laboratory. The results found that ***Organophosphorus and urea*** poisoning were contaminated in the buffalo carcass. Few days after one vulture was found dead at Segur range. The necropsy found no lesions in the joint cavity, no drug residues at visceral organs revealed by forensic lab. Astonishingly these samples were also noticed same ***Organophosphorus and urea*** poisoning from the laboratory result. Here I concluded that vultures deaths in this landscape was mainly due to deliberate poisoning of carcasses. No doubt every safe disposal of livestock carcasses would definitely save the critically endangered vulture species in this region rather than drug residues.

Enclose

Regional Forensic Science Laboratory report

உள்ளடக்கங்கள் :
Enclosures :

Sub: Examination of viscera of Vulture and Male Elephant.

Ref : Your letter dated 05.01.15.

பார்வை :
Reference :

The following items were received here on 08.01.15 with proper labels through Mr. K. Siddaraj, Forest Guard, under unbroken seals which corresponded with the sample sent.

The results obtained on examination are noted against each viz.

1. Vulture Crop contents.

   Detected Organophosphorus compound and Urea.

2. Vulture Intestinal contents.

   Detected Organophosphorus compound and Urea.

3. Male Elephant.

   Did not detect poison.

4. Preservative.

   Did not detect poison.

Note: Organophosphorus compounds are poisonous and are used as insecticide and urea is a diamide and is used as fertilizer.

(Dr. P.KIRUBAKARAN, M.Sc.,Ph.D. B.L.,)
Dy. Director and Asst. Chemical Examiner to Govt.

(V. Sivasubramanian, M.Sc.,)
Junior Scientific Officer.

Note : In case of Evidence summons may kindly be issued to V. Sivasubramanian, M.Sc., Junior Scientific Officer.

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* அழைப்பாணைகள் ஏதும் வழங்கும்போது த.அ.து. பார்வை எண்ணைக் குறிப்பிடவும்.

* While issuing summons, if any, please quote FSD reference Number.

THE SURVEY ON PREVALENCE OF NON STEROIDAL ANTI-INFLAMMATORY DRUGS (NSAIDS) IN THE NILGIRIS, TAMIL NADU

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ABSTRACT

Veterinary use of the non-steroidal anti-inflammatory drug diclofenac on domesticated ungulates caused populations of resident *Gyps* vultures in the Indian sub-continent to collapse. The birds died when they fed on carrion from treated animals. Veterinary diclofenac was banned in 2006 and meloxicam was advocated as a 'vulture-safe' alternative. We examine the effectiveness of the 2006 ban, whether meloxicam has replaced for diclofenac in veterinary practices and other NSAIDs prevalence survey in medical shops in the Nilgiris. The diclofenac prevalence study was conducted in 107 medical shops in 18 locations from the Nilgiri district. Of which Ooty area holds more (n=25) number of medical shops followed by Coonoor (n=19), Gudalur and Kotagiri (n=13). On the other hand lowest number of medical shops was found in Kolapally, Nellakotai each one shop respectively. Among the 107 medical shops and 19 medical shops sold veterinary as well as human medicines and remain 88 shops sold human medicines only in the Nilgiris. 3 ml human used Diclofenac vial sale was observed in the all medicals shops. 93 medical shops personal were aware about the ban of diclofenc. The reason for ban of diclofenac drug related issues most of them were (n=61) clearly know about the ban for the effect an vulture population considerable among (n=2) the shop keepers opined that the diclofenac was banned its effect on side effect and scavenging birds,few of them (n=12) that the drugs side effect on all animals. Knowledge on other NSAID harmful drugs such as ketoprofen, Acelofenac, Flunixin and Nimesulid to vultures questionnaire result showed that the most of the (n=86) medical shop keepers were well aware. Among the 107 medical shops intensive survey was carried out on the 19 medical shops sold veterinary as well as human medicines medical shops for NSAIDs prevalence the result shows that drugs was purchased mainly by livestock holders as per the veterinary doctor's prescription and they all are very well knowledge on diclofenac ban and the reasons. Knowledge on other NSAID harmful drugs such as Acelofenac, Flunixin and Nimesulid to vultures questionnaire result showed that the most of the (n=11) medical shop keepers were not aware. Total of 8 medical shops were aware of ketoprofen ban and withdrawn from Tamilnadu state Animal Husbandry Department was known. It's interesting to note that Meloxicam was the fastest selling pain killer in all 19 medical shops. In a nutshell more awareness is needed for medical shops to aware of other NSAIDs in Nilgiris.

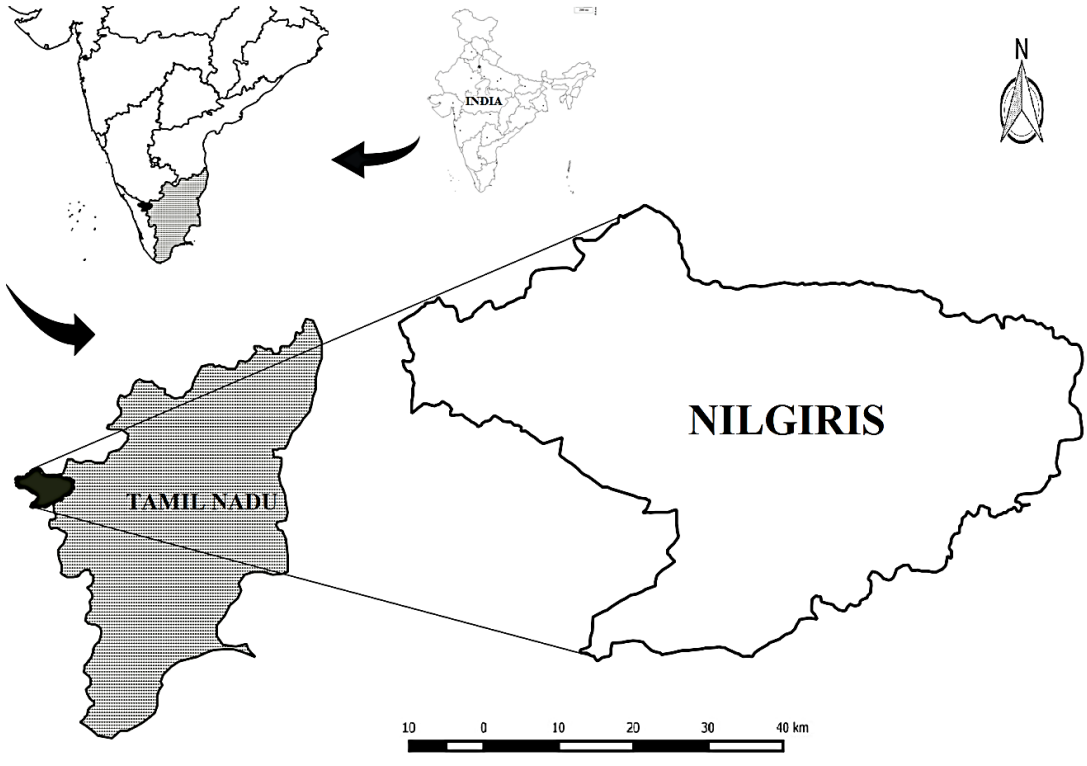
Keywords: non-steroidal anti-inflammatory drugs, vultures, diclofenac, meloxicam, medical shops scavengers.

Introduction

Veterinary use of the non-steroidal anti-inflammatory drug diclofenac on domesticated ungulates caused populations of resident *Gyps* vultures in the Indian sub-continent to collapse. Three species of vulture, endemic to South Asia, White-rumped Vulture *Gyps bengalensis*, Indian Vulture *G. indicus,* and Slender-billed Vulture *G. tenuirostris* are endanger of extinction because their food supply is contaminated with diclofenac, a non-steroidal anti-inflammatory drug (NSAID) used for veterinary treatment of livestock (Oaks *et al.,* 2004). Surveys of livestock carcasses across India indicate that over 10per cent contained diclofenac residues (Taggart *et al.,* 2009) that occur at sufficient concentrations, in relation to dose-dependent mortality of the Oriental white-backed vulture (*Gyps bengalensis)*, indicating that diclofenac is the sole cause of the population crash (Green *et al.,* 2007). Safety testing has established that the NSAID meloxicam is an effective and vulture-safe alternative to diclofenac (Swan *et al.,* 2006b).However, although meloxicam is now used in South Asia and the manufacture and sale of veterinary diclofenac has been banned, meloxicam remains more expensive and human formulations of diclofenac are being used to treat livestock. In this paper, we describe safety-testing experiments on Gyps vultures for ketoprofen, an NSAID already in use in South Asia, following the protocols recommended by Swan *et al.* (2006b). Previous data indicated that the clinical treatment of vultures and other scavenging birds with ketoprofen resulted in no confirmed mortality associated with kidney damage (Cuthbert *et al.,* 2006), and that it is rapidly eliminated in livestock (EMEA 1995). Therefore, NSAID survey was adopted in 2017 as part of the 107 human and veterinary Medicines in Nilgiri district on behalf of Arulagam(NGO). In two phases, only 19 medical shops were sold both the veterinary and human durgs. And then those 19 shops were surveyed again for the further details.

Study area

The Nilgiris or "Blue Mountains" is a major part of the Nilgiri Biosphere Reserve. The Nilgiris is situated (11, 12' and 11, 43' North and 76, 14 and 0 77, 1' East) in the North Western corner of Tamil Nadu in Southern India. They are bounded on the North by the State of Karnataka and in the West and South West by Kerala and East and South by Coimbatore district of Tamil Nadu (Map 1). The Nilgiris occupies a total area of 2542.49 sq. km and the elevation of the Nilgiris ranges from 300 to about 2,700 meters. Nilgiris, as the most forested district of the state, signifies an important stretch of Western Ghats in Tamil Nadu and is the junction of the Western and Eastern Ghats. The peak of Doddabetta is the highest elevation in Nilgiris with an altitude of 2637 meters. There are other hills namely Elk hills, Devarshola hill, Hulical hill and Cairn hill. The present study was conducted in the Upper Nilgiris (above 1000 m MSL).



Map 1. Descriptive pamp of the Nilgiris

Methodology

This NSAID Prevalence survey has been taken in pharmacies in 100 kilometers of areas covered by the Vulture save zone. The malfunction took place in the Nilgiri area of 107 pharmacies**.** The diclofenac prevalence study was conducted in 107 medical shops in 18 locations from the Nilgiri district. Of which Ooty, Coonoor, Gudalur. Kolapally, Nellakotai. The study was aimed to explore the NSAID prevalence in drug stores were collected using questionnaire survey in Nilgiris**.** Two sets of questionnaire were developed for this study. On was "Precise and Closed" and other one was "Broad and Open ended. The respondents were briefed about the purpose of the visit and verbal consent was taken for voluntary participation in interviews. Face to face interviews were made it easier to clear any ambiguity had about the question.

Result and Discussion

Veterinary diclofenac was banned in 2006 and meloxicam was advocated as a 'vulture-safe' alternative. We examine the effectiveness of the 2006 ban, whether meloxicam has replaced for diclofenac in veterinary practices and other NSAIDs prevalence survey in medical shops in the Nilgiris. The diclofenac prevalence study was conducted in 107 medical shops in 18 locations from the Nilgiri district. Of which Ooty area holds more (n=25) number of medical shops followed by Coonoor (n=19), Gudalur and Kotagiri (n=13). On the other hand lowest number of medical shops was found in Kolapally, Nellakotai each one shop respectively. The diclofenac prevalence survey on medical shops shows that among the 107 medical shops only 19 medical shops were used for veterinary use and remaining 88 shops were human purpose only. The medical shops owners were well known about the ban of diclofenac and other ban drugs on their effect on vulture population. 3 ml human used Diclofenac vial sale was observed in the all medicals shops. 30ml veterinary used Diclofenac vial note sale was observed in the all medical shops. 93 medical shops personal were aware about the ban of diclofenc (figure 2). The reason for ban of diclofenac drug related issues most of them were (n=61) clearly know about the ban for the effect an vulture population considerable among (n=20) the shops keepers opined that the diclofenac was banned an its effect on side effect and scavenging birds, few of them (n=12) that the drugs side effect on all animals (Figure3). Diclofenac sale was observed the entire medical shops particularly cattle holders were buy the diclofenac drug most of the time (figure1). According to Diclofenac is widely used in human medicine globally, but it was established to the veterinary market on the Indian subcontinent during the early 1990s. The drug is cheap and extensively used in the treatment of inflammation, pain and fever in livestock. Knowledge on other NSAID harmful drugs such as ketoprofen, Acelofenac, Flunixin and Nimesulid to vultures questionnaire result showed that the most of the (n=86) medical shop keepers were well aware (Table1). Among the 107 medical shops intensive survey was carried out on the 19 medical shops sold veterinary as well as human medicines medical shops for NSAIDs prevalence the result shows that drugs was purchased mainly by livestock holders as per the veterinary doctor's prescription and they all are very well knowledge on diclofenac ban and the reasons. Total of (n= 8) medical

shops were aware of ketoprofen ban and withdrawn from Tamilnadu state Animal Husbandry Department was known. Knowledge on other NSAID harmful drugs such as Acelofenac, Flunixin and Nimesulid to vultures questionnaire result showed that the most of the (n=11) medical shop keepers were not aware. Of which (n=8) medical shop keeper was aware .It's interesting to note that Meloxicam was the fastest selling pain killer in all 19 medical shop. This present study revealed that most of the livestock holders are illiterate and they do not aware about the Diclofenac and their uses. But they were known about the vulture conservation in forest ecosystem. The present study have been supported that a positive conservation altitude is the key for garnering local support for vulture conservation. Education campaigns, such as street theatres and allocating posters in local languages stress forecast and threats of vulture conservation, should be performed to explain the general public. These programmes may improve the awareness of people to a broad range of the values of vultures. Another significant approach would be to educate livestock holders, farmers and veterinary personals on the negative effects of Diclofenac and on the suitable throwing away of contaminated carcasses. Green et al (2004) stated that based on demographic modeling, it has been establish that less than 1% of lethal level of diclofenac can reason a hasty population crash to vulture.

Conclusion

Educating livestock holders, farmers and veterinary personnel may help to secure healthy food for vulture. A long-term solution would be the incorporation of environmental education in school and colleges and to pay more compensation for securing the country's southern most vulture population. In a nutshell more awareness is needed for medical shops to aware of other NSAIDs in Nilgiris. Major vulture population is in Southern India in Moyar. Hence I request Tamil Nadu veterinary department to take over the responsibilities to carry out the NASID prevalence survey in Nilgiris in order to conserve the last southern most wild viable vulture population in Moyar valley Nilgiris.

Figure 1. Details of diclofenac purchase

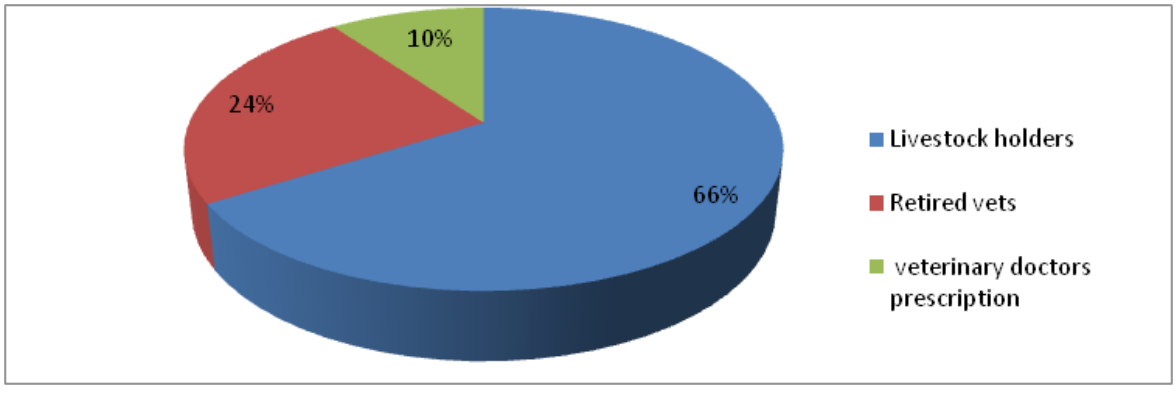


Figure 2. Knowledge on diclofenac ban related issues among the medical shops

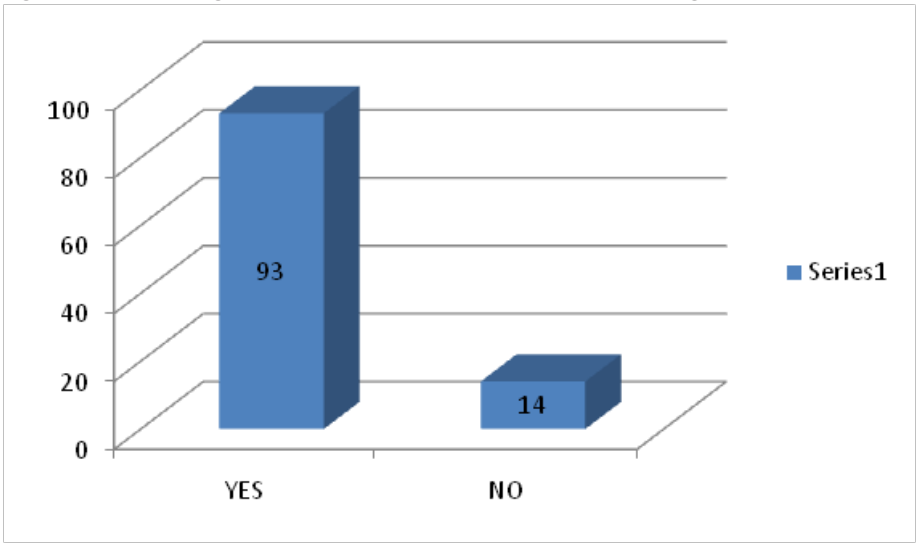


Figure 3. Knowledge on diclofenac drug effect on vulture population among the medical shops

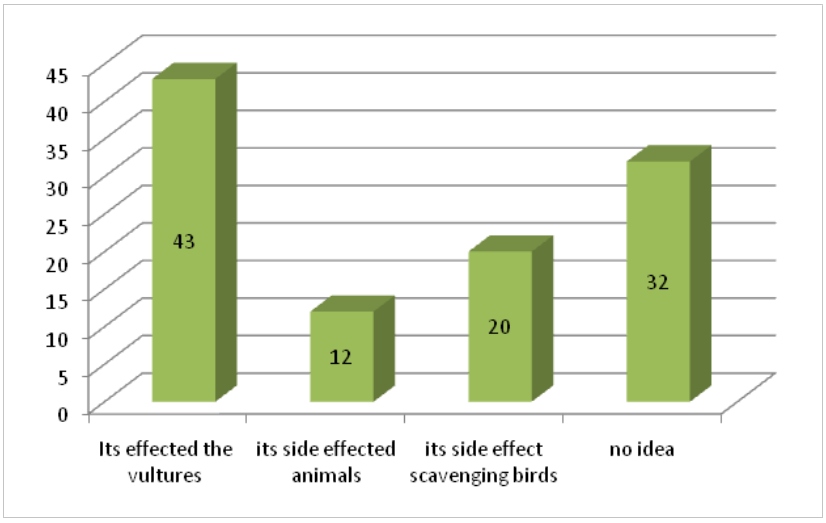


Table 1 knowledge on other banned NSAID drugs among the medical shops

Total number of respondent	Do you know other harmful drugs such as ketoprofen, Acelofenac, Flunixin and Nimesulid to vulture	
107	**Yes**	**No**
	86	21

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LEGAL BATTLE TO REMOVE THE STAY ON THE BAN OF MULTI DOSE VIALS OF DICLOFENAC

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Abstract:

The Union government's decision to ban multi-dose vials of painkiller drug diclofenac for veterinary use, sparked hopes for the survival of the critically-endangered vulture species, the nature's clean-up crew!

The drug was still available in large multi- dose vials of 30 ml labelled '*not for veterinary use*', facilitating the illegal veterinary use of the drug, which caused further decline in vulture populations.

As a big boost to vulture conservation, the union ministry of health and family welfare, passed a total ban on multi-dose vials of diclofenac, through a notification issued on July 17, 2015. The notification said that the diclofenac formulation for human use will henceforth be available only in single dose vials of 3ml.

This ban was challenged by a pharmaceutical company and the stay was issued on 29th December, 2017 by the Madras High Court. It took 2 years for the hearings to be completed and a judgement was passed by the High Court in October, 2017 which reinstated the sense of hope to vulture conservation.

Keywords:

Vulture, multi-dose vials of diclofenac, impugned provision, petition, affidavit,

Introduction:

A notification issued on July 17, 2015 by the health ministry states that the diclofenac formulation for human use will henceforth be available only in single dose pack. This brought a relief to vulture conservationists, but that relief was short lived. While I made a casual visit on the morning of 29-12-2015, to meet Dr.Vijaykumar, a veterinary doctor, he showed me the news item appeared in the newspaper "High Court Stays the prosecution over the ban of Multi Dose Vials of diclofenac. It was a shock and I was stunned for a moment. After a while, I started thinking what to do next. The task was humungous - limited resources, lack of legal expertise, the urgency of conservation of vultures all in front of us and a formidable adversary in the form of the pharma companies. The sad news was shared with fellow conservationists and they expressed their concern over the news. I wanted to collect the case details based on this news. I had no previous experience in court proceedings. I was forced to face the situation head-on.

Way forward overcoming constraints

I contacted *Lajapathirai* , an Environmentalist Advocate known to me. Since he is practising in the Madurai High Court, he directed me to contact an Advocate *Thilakeswaran,* who practises in the Madras High Court.

When I contacted him, he asked me to come in person. I travelled to Chennai the very next day and explained to him about vultures and the urgent need to save them. He wanted to know the details of the writ petition by the drug companies to prepare a Petition for impleading and said that this might take a few weeks and he would call me after collecting the details. His words encouraged me when he said, he would not demand fees, and accept what I can afford, as he wanted to be part of this good cause.

He called me within a week and informed that he had collected the case documents. He also informed me that the document copy could be collected from his office before 6pm. It was already 5pm then.

I contacted *Nagaraj*, my friend, who was near the advocate's office and I requested him to collect the documents. He collected the documents within an hour and called me. After that, I contacted and requested my friend *Britto* to scan and send me the documents. It was already 8pm and he could not do it. Then I contacted *Ragunath Krishna,* a volunteer of Arulagam. He agreed to help and sent the scanned copy to me by email the same night.

I went through the details. I was not able to grasp most of the ground raised by the petitioner. I was kept on reading and extracted following points from the affidavit filed by the company.

The Details of the Case

The writ petitioners attacked the provision in the ban of Diclofenac injections and its formulations in animal use on various grounds and they can be summarized as follows:

a. The basis for introduction of the ban is not supported by any systematic, scientific and long duration study and the same has not been documented by any Governmental Agency.
b. The ban has been brought in, not on account of misuse on human beings, but on suspicion that vultures die on feeding on carcasses of animals, which were administered the Drug, i.e., Diclofenac 72 hours before their death;
c. Diclofenac injections in 30 ml multi dose packs are supplied only to specialty hospitals and Nursing Homes, besides registered Medical Practitioners. They are economical and efficacious;
d. MDV of Diclofenac injection are absolutely essential for treatment as an analgesic i.e., as an NSAID for various conditions in human beings.
e. There are malafides behind the introduction of the ban as the same has been brought in to promote one particular pharmaceutical company.

f. There is no evidence on record to show that Diclofenac has been misused and diverted in large scale for use in animals.
g. The ban was issued prior to conclusion of Drugs Technical Advisory Board (DTAB) constituted for this purpose which held its 63rd and 64th meetings held on 16.05.2013 and 19.07.2013 respectively.
h. If the diclofenac drug for human use is used illegally to treat animals, there are many ways to control the misuse.
i. The drug was manufactured prior to the ban order and distributed all over India and it is not possible to withdraw all of them. Hence, action on pharmacists by authorities should be stopped immediately.

Experts' Role

Due to my knowledge is limited, I shared the case details with experts in this field namely *Vibhu Prakash*, Sashikumar, *Chris Bowden* and *Toby Galigan* and requested them to send scientific details to respond to this writ petition. They sent all scientific documental evidences published in international journals and ban orders for diclofenac in Nepal, Bangladesh, Pakistan and Iran issued in their official gazettes. We attached the proven claim by Professor *Rhys Green* of University of Cambridge that just 1% of diclofenac residue in a carcass is sufficient to kill thousands of vultures.

I also shared the details and got the opinion of K. Mohanraj, Homi RSK, Devendra Swaroop and Jagati. I collected and submitted all the above documents to the advocate, but he expressed his time constraints to read all the research papers and requested us to highlight the relevant sections. *Sasikumar* of Malabar Natural History Society helped in this exercise and attached remarks, which were submitted to the advocate.

The advocate wanted to include the details such as my background and what motivate me to show interest in this case. I provided him the details that I have been working for 25 years in environmental conservation and I have been working to conserve vulture species in Tamil Nadu during the past five years. Besides, I have written 3 books and more than 200 articles in Tamil language on wildlife and environmental issues. He included those details and submitted the impleading petition.

Our Response to the petition

Our submissions can be broadly summarized and encapsulated as below:

a. Vultures play the critical role of sanitizing the ecosystem as a keystone species. They are irreplaceable.
b. There is enough statistical and scientific proof to show the decline in vulture population and that diclofenac is the major cause.
c. Since they are critically endangered, collecting carcasses of vultures for test of contamination of diclofenac is very difficult.
d. The ban was introduced in public interest on the basis of sanctified precautionary principle.
e. People prefer to use diclofenac as it is cheaper than the alternate safe drug.
f. Using 30 ml vials on many people or repeatedly on a single individual may cause contamination.
g. Since it is people that purchase drugs for both cattle and themselves, it is difficult to know who they are purchasing them for.
h. The judgement given by Justice *K. S. Radhakrishnan* on "Protection of Wild Buffalo" is a precedent where the judgement was given without full scientific evidence considering the gravity of the situation.
i. India is a signatory to the 1992 Biodiversity Convention and therefore should not allow the decline of vulture population, as the objective of the biodiversity convention is that, wherever there is threat of reduction or loss of biological diversity, lack of full scientific certainty should not be used as a reason for postponing measures to avoid or minimize such a threat.

The day arrived

18-02-2016, It was the first time I entered the court proudly for a public interest case.There were a lot of cases to be heard on that date and I was eagerly waiting. Our case was taken only in the late afternoon session for hearing. Our advocate felt that it would be more appropriate if senior advocate *Radhakrishnan* appeared for this case and requested him to do so.

So, *Radhakrishnan* appeared and pleaded that there are strong evidences to prove that diclofenac is the cause for reduction in vulture population and even though the drug is banned but the pilferage continued. Moreover, banning the drug is the policy decision taken by government of India. Hence the stay order to be vacated.

The Objections by the Pharma Companies

The advocate appearing for the Pharma Company objected my intervention stating that I don't have a scientific background and I have no rights to respond. And that only the union government should respond to us. Moreover, all the information that I submitted were downloaded from the internet. Hence his impleading petition to be dismissed.

Intervener

However, the honourable judge allowed me to continue as an intervener. This gave me an opening to witness and get periodic updates about what was going on in the hearings. Vibhu prakash and Sashikumar gave me a moral support by joining me couple of time during the hearings.

Judge remarks

The honourable judge questioned the urgency of announcing the ban without waiting for the DTAB report. The government responded stating that the ban was not on the drug itself, but only on the size of the vials and hence there was no need of waiting for the expert opinion. But the honourable judge did not accept this argument. He ordered the drug control office to form a committee and submit a report. The case was adjourned to next hearing.

Another threat

Based on the traction that *Laborate* got from this case,

another company named *Alpa* joined as a second petitioner, whereby they would benefit from the proceedings.

Court order

Since there was no progress in forming a committee until the next hearing, the honourable high court in its hearing dated 17th June, 2016 directed: "minutes of DTAB dated 16th May 2013 should be given affect to and committee of the persons mentioned aforesaid stands constituted to submit its report to the DTAB with a copy to be placed before us. The committee may also obtain the opinion of the petitioner".

The hearings were repeatedly postponed for the next 6 months due to non-receipt of the expert committee report. Meanwhile, *Seshan*, a wildlife enthusiast, joined as an impleader and advocate *Yogeshwaran* appeared for him.

The Petitioner's Response:

Table 1

Financial Year	30 ML	3 ML
2007 - 08	3321180	2817500
2008 - 09	7868970	3246000
2009 - 10	10532225	2301550
2010 - 11	6243384	4095194
2011 - 12	7624220	4755000
2012 - 13	8566180	8753500
2013 - 14	10065550	13554050
2014 - 15	17029175	9321750
2015 - 16*	18929070	5840650

Finally, the committee submitted their report during January 2017 after sitting through as many as 9 meetings.

The Committee Report

In that report, committee pointed out that the decision of DTAB was minuted in 2013 but the notification was issued two years later. The reasons for this gap were not clear.

Questions to the petitioner

As per the direction of the court, the committee also tried to obtain the petitioner's view by raising the following questions

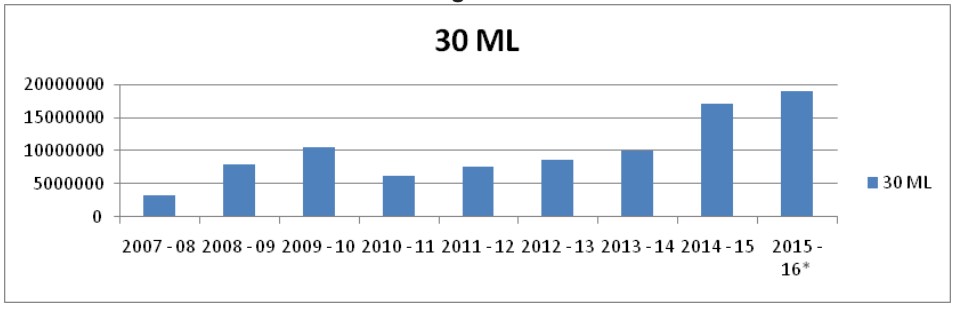
a. Production data of diclofenac injection of all pack sizes manufactured by you year wise since 2008 till date.
b. Market share of your formulations of diclofenac injections
c. Financial loss suffered due to the restriction of pack size of diclofenac injection
d. Number of other manufactures of MDV of diclofenac

The petitioner responded only for the production details of year-wise production. They have not responded to the rest of the questions. From the figures we can deduce that they have not faced any financial loss, but substantial increase in the sale of 30 ml and 3 ml vials.

*Our visualisation based on figures provided by the petitioner can be seen below in figures 1 & 2.

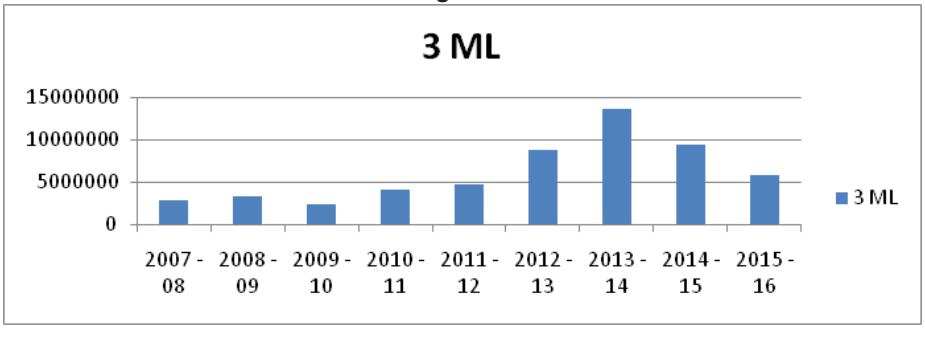
This showed the production grew significantly (25 times increase) when there was an expectancy of ban coming through. This seemed to have been deliberate.

Figure 1



*It is to be noted that the figures pertaining to 2015 – 16 only shows their production from April to June 15th (just 75 days). This is only in the case of the 30 ml vials.

Figure 2



Recommendations by the Expert Committee

The expert committee also obtained the views of the department of Drug control, MoEF & CC, Animal Husbandry and scientist Dr.Vibu Prakash. Based on those, the committee recommended as below.

The prohibition of diclofenac resulted in significant reduction rate of death of vultures as demonstrated by modelling studies. This justifies the continued prohibition of use of diclofenac in animals. Further, additional measures of reducing the environmental contamination of diclofenac and other pharmaceutical products namely other NSAIDs, antibiotics, anticancer drugs etc. be enforced. This can be done by a synergy and comprehensive approach by regulatory bodies, pharmaceutical industry, public awareness, stringent enforcement of biomedical waste regulations etc..

1. Although the correlation of diclofenac residue has been shown with reduction in vulture population, still stronger evidence is required. Therefore, continued adequately powered well-structured epidemiological studies and casualty studies are required.
2. As far as the MDV pack size of diclofenac injection meant for human use is concerned, there is no strong evidence of its pilferage leading to its misuse in animals, which is sufficient to cause significant adverse impact in vulture population. However, the possibilities of its misuse in animals as alleged by NGO's cannot be ruled out.
3. The committee is of the opinion that no disadvantage to the patient community will occur by withdrawing the MDV of diclofenac as a precautionary approach. More evidence based data and not the opinion or perception is required to take a considered view on withdrawal of MDV of diclofenac for human use. This also includes feedback from practising physicians, clinics, nursing homes and hospitals.

Though the report was unbiased, it was a double-edged sword and we could not make much headway with the same. But honourable judge drew valid point from the report like …'misuse of the drug cannot be ruled out'.

Response from the Deputy Drug Controller

Mr. Manivannan, Deputy Drug Controller submitted the counter-affidavit to the petition with passion and enthusiasm. This was a shot-in-the-arm to our case. The grounds on which Union of India defended the impugned provision can be broadly crystallized and summarized as follows:

a. Vultures are universally accepted as Natural Scavengers and absolutely essential for environmental and ecological balance. Therefore, preservation of vulture population is non-negotiable.
b. The ban has been introduced in public interest.
c. The ban has been introduced after taking into account the views of stakeholders. Views of stakeholders were obtained by publication of draft rules and inviting objections and suggestions from the stakeholders and public on the proposed impugned provision.
d. The possibility of misuse of 30ml packs in animals and the possibility of diversion for use in animals cannot be ruled out even according to the report of the Expert Technical Committee appointed by this Court.
e. As a corollary to the preceding point, Government of India would submit that they have brought in the ban on the basis of the sanctified precautionary principle impelled by public interest.
f. The pharma companies seem to have just their commercial interest, without social responsibility.

Argument by senior Government Counsel

Senior Government Counsel *Rajagopalan* refuted the argument from the petitioner that the government institutions have not done any study on the role of misuse of diclofenac and their impact on vulture population. In support of this, he quoted a study done by the Indian Veterinary Institute, where it has been clearly documented how the drug was being misused with state-wise data. He also brought the judges' attention the judgement against Macleods Pharmaceuticals Limited, which was given on the basis of precautionary measures without sufficient scientific evidence.

Summary of discussions and judgement

On patient hearing of both parties, the Hon'ble Ms.Indira Banerjee, Chief Justice and The Hon'ble Justice Mr. M.Sundar delivered their historic milestone judgement in protecting not only vulture species but also other endangered species.

One of the highlight in the verdict was the court chose to use the term 'Natural Sanitary Worker' instead of the term 'Natural Scavenger'.

Vultures are universally accepted as sanitary workers, which clear carcasses of domestic livestock/cattle and thereby protect ecological balance. 'Vulture population in India is on the decline, it has an adverse impact on the ecological balance / environment and therefore, such decline in vulture population needs to be arrested' - this is the central theme of the genesis of this lis.

There is no dispute amongst the parties to the lis before us that the aforesaid vultures are critically endangered species and the nucleus is a pharmaceutical product, which goes by the name Diclofenac.

The expert committee filed its detailed report in this Court on 01.02.2017. The findings returned by the expert committee to the effect that the possibility of misuse of Diclofenac in animals has, as urged by Non-Governmental Organisations (NGOs) cannot be ruled out.

The Committee is of the opinion that no disadvantage to the patient community will occur by withdrawing the MDV pack size of diclofenac injection as a precautionary approach.

One crucial aspect of the matter to be noted is that the petitioners were given adequate opportunity by the Expert Committee, but the writ petitioners replied to just one of the many questions.

The study was not conducted just by the NGOs, but also by the Indian Veterinary Research Institute, which conducted a state-wise study of the presence of Diclofenac-

positive ungulate samples, which shows the rampant use of diclofenac.

We cannot wait till we get complete evidences and researches; it will be too late to act. The precautionary principle and the polluter pays principle have been accepted as part of the law of the land.

The state shall endeavour to protect and improve the environment and to safeguard the forest and wildlife of the country, to protect and improve the natural environment including forests, lakes, rivers and wildlife and to have compassion for living creatures.

There is a need for an exclusive parliamentary legislation for the preservation and protection of endangered species, so as to carry out the recovery programs before many of the species become extinct.

a. Article 21 of the Constitution of India guarantees protection of life and personal liberty.
b. Articles 47 of the Constitution talks on duty of the State to raise the level of nutrition, the standard of living and to improve public health;
c. Articles 48A of the Constitution guarantees Protection and improvement of environment and safeguarding of forests and wild life;
d. Articles 51 A(g) of the Constitution guarantees to protect and improve the natural environment including forests, lakes, rivers and wild life, and to have compassion for living creatures.

As we are accepting the precautionary principle theory advanced as an argument by the learned Solicitor, lack of decline in vulture population post 2012 argument of writ petitioners also pales into insignificance.

Moreover, referred to what the Supreme Court had to say in a judgment; National Wildlife Acton Plan- NWAP (2002-2016) has already identified species like the Great Indian Bustard, Bengal Florican, Dugong, the Manipur Brow Antlered Deer, over and above Asiatic Lion and Wild Buffalo as endangered species and we are therefore inclined to give a direction to the Government of India and the MoEF to take urgent steps for the preservation of those endangered species as well as to initiate recovery programmes.

Petition dismissed

Finally, the Court dismissed the writ petition by Laborate Pharmaceutical India Ltd. and Alpa Laboratories Ltd and upheld the ban on MDV of diclofenac and the drug will be available only in single dose vials of 3ml. This judgement is an important one and will save vulture species and the environment.

Appreciation by the court

In the judgment, Honurable Judge appreciated our role and mentioned as two public spirited individuals *Seshan* and *S.Bharathithasan* for submitting various documents.

Acknowledgments:

My contribution in this court case is limited; however I should mention many individuals who helped voluntarily.

All hearings will be notified only on the previous day late evening and Mr. Sundar, assistant to government counsel informed the same to me each time through text messages by night. I record my sincere thanks to him.

Lenin and Nagaraj, Volunteers of Arulagam made arrangement for travel tickets and stay etc for every visit to Chennai for attending the court hearings. Mac Mohan needs a mention here for giving advices including the Precautionary principle. Encouragement from Jack Tordoff, Sashikmar, Chris Bowden, Vibhu, Toby, Homi RSK, also should be mentioned here.

Bird enthusiast, Mr. Chandrasekar gave the book “Aftermath of diclofenac & Vulture conservation in NBR”.

I would like to mention the contribution of the following persons in this case. Advocates Thilageswaran, Radhakrishnan, Yogeswaran, Santhanaraman of the Green Tribunal, Junior Advocates – Vetriselvan Surya and Nila. I also would like to mention my appreciation for the timely hep of the following persons Britto, Vasanthi Rubert, Kalaivani Anand, Seshan, Logeswari and Rammohan. I also want to express my sincere thanks to the media especially The Deccan chronicle and The Hindu.

That I could spend the better part of the last 2 years with peace of mind was entirely due to the limitless love and patience of my family. Their support ensured that I remained strong and willing to take up any challenge that came my way.

I also would like to mention and extend my sincere thanks to Mr. Kalyanasundaram and Raghunath for translating this article from Tamil to English.

The Chronology of Events

Chronology of events		
S No	**Hearing Date**	**Event**
1	27.11.15	Gazette Notification dated 14.6.15 on Ban of MDV of diclofenac challenged by laborate pharma
3	29.12.15	Stay order issued by the court, because the ban was issued by drug controller before obtaining the expert committee report
4	17.2.16	Impleading petition filed by me
6	18.2.16	Drug Controller Report submitted to the court
7	07.4.16	Judge questioned why did the ban was not formed
8	17.6.16	Judge ordered to form the Committee
9	23.8.16	Court itself formed the committee
10	01.2.17	Expert Committee Report submitted
11	24.10.17	Stay removed

Supported documents

1. Collapse of Asian Vulture Population -- Rhys E.Green et all. - Journal of applied ecology
2. Diclofenac residues as the cause of Vulture population decline - Pakistan - Lindsay oaks et all - Letters to Nature
3. Diclofenac poisoning is widespread in declining vulture populations across the Indian Subcontinent - Susanne Schultz et all - Proceedings of The Royal Society
4. Toxicity of diclofenac to Gyps vultures - Gerry E swan et all Bilogy letter
5. Rate of decline of oriental WBV - Rhys E.Green et all. - PLOS one
6. Recent Changes of population - V.Prakash et all - JBNHS
7. Assesing the ongoing threat - Richard J.Cuthbert et all - Oryx
8. The population decline of Gyps vultures in India and Nepal - Vipu prakash et all - PLOS one
9. Postmortem report- SACON, India - Dr. Muralidharan, SACON
10. Continuing mortality of vultures in India - Richard J.Cuthbert et all - Oryx
11. Diclofenac monitoring in cattle and buffalo carcasses surveyed in 2009-10 & investigating other causes of mortality in vultures in India - IVRI & BNHS
12. Action plan for Vulture Conservation in India, MoEF-GOI
13. Supreme Court of India- TN Godavarman Thirumalpad Vs Union of India - Judgement by Justice KS Radhakrishnan
14. The urgent need and justification for ban of all multi dose human diclofenac vials larger than 3ml - Chris Bowden
15. Regional Declaration on the conservation of South Asia's Critically Endangered Vulture Species - Governments of Bangladesh, Nepal, India & Pakistan

MALIGNED HERO-BIRDS: IMPORTANCE OFCONSERVATION AWARENESS PROGRAMMES ON VULTURE CONSERVATION

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ABSTRACT

Education is crucial to conserving vultures. Zoo Outreach Organization, on realizing the enormous decline of vulture population by ingesting a drug, initiated its vulture conservation education programs in 1990 by carrying out a survey on status and management of vultures in Indian zoological Gardens. Utilizing the data generated, education materials were developed for a range of target groups. In 2004 vulture conservation education programme was extended for South Asian countries. In 2012 the vulture education materials were revised for updated information. All these materials were well received and utilized by a range of wildlife and environmental educationist across India and South Asian countries that created measurable impact on vulture conservation. The principle, approach, contents of the education programmes, education tools and methods, feedback from the educators, and future conservation recommendations are discussed in detail.

A SYNOPSIS OF VULTURE SAFE ZONE ACTIVITIES UNDERTAKEN BY ARULAGAM 2012-17

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ABSTRACT

Vulture Safe Zone (VSZ) concept is implemented in 2013 by covering four districts in Tamil Nadu namely, The Nilgiris, Coimbatore, Erode and part of Tirupur districts. Concerted efforts were given by joining hands with diverse stakeholders. Various programmes right from the street theatre, puppet show, rally, human chain, exhibition, survey, sports event, carnivals, advocacy for policy change and etc., were organized for sensitizing the stake holders. Remarkable impacts like withdrawn of ketoprofen from animal husbandry department, periodic raids conducted by the department of drug control, vulture conservation resolution in *gramasabha*, legal battle in removing the stay order for diclofenac, and etc., were made. Conservation of the critically endangered vulture species is an enormous task. However, the rate of decline has stalled by the timely intervention of great naturalists and scientists from all over the world. Arulagam did its level best in Tamil Nadu.

Key words: Stake holders approach, Vulture Safe Zone, Vulture Conservation, diclofenac

Introduction

There are four species of vultures, Oriental White-backed Vulture (OWBV); Indian (Long-billed) Vulture (LBV); Red-headed Vulture (RHV); and Egyptian Vulture recorded in Tamil Nadu. Egyptian vulture is categorised as endangered and rest of three vultures are critically endangered. Arulagam is trying to establish Moyar valley as a permanent safe zone for vulture with the support of diverse stakeholders.

Objectives

Arulagam is working in the Moyar valley for the past five years with following objectives.

- To establish a network with diverse stakeholders to join hands in vulture conservation
- To ensure a safe and secure environment for the revival of vulture species in sustainable level in South India.
- To monitor vulture breeding colonies

Project Outputs

The following are the highlights of our projects.

- Resolutions to protect vulture species were passed at the Gram Sabhas (local administration) in the districts of Coimbatore, The Nilgiris and Erode. With pride, we would like to record that it is a pioneering model even at the National level
- Due to the intervention of 'Arulagam', the Drug Control Department, Government of Tamil Nadu is undertaking periodic inspections so as to ensure that the banned drug is not available in core areas such as Coimbatore, The Nilgiris and Erode
- The first breeding record of Indian long-billed Vultures (LBV) (five pairs) was recorded in Nilgiri North Forest Division.
- New breeding colonies of Oriental White-backed Vulture (OWBV) and LBV nests were recorded in Moyar Valley for the first time
- Cinereous vulture, Himalayan Griffon Vulture and Eurasian Griffon Vulture were recorded for the first time in the landscape on different occasions. (It was published in Social media and daily newspapers)
- Vulture Working Group has been initiated in South India
- Arulagam has developed "Recovery plan for vultures in Tamil Nadu" and submitted to the higher officials in Forest, Drug Control and Animal Husbandry Department

Initiative by Animal Husbandry Department of Tamil Nadu

- At the behest of Arulagam the Animal Husbandry Department has withdrawn the procurement of ketoprofen (another drug akin to diclofenac) which has been proved inimical to vultures. With satisfaction, we would like to record that this is the first achievement in the whole world. It was instrumental to ban the ketoprofen drug for the veterinary use in Bangladesh
- Circulars with warning message were issued to the Veterinary Doctors in and around NBR about the misuse of the banned drug by the Department of Animal Husbandry

Initiative by Forest department

- Vulture Watchers were appointed for ensuring better protection of Vultures in Sathyamangalam Tiger Reserve
- Naturally dead wild animal carcasses are allowed to vultures. It ensures and increases the availability of safe food
- Vulture Conservation Agenda was included in the management plan of Mudumalai & Sathyamangalam Tiger Reserve of State Forest Department, Government of Tamil Nadu
- State Forest Department has initiated "Society for Wildlife Interface and Forestry Training" (SWIFT) with Vulture conservation as one of the three focal scheme
- By Arulagam's genuine efforts and guidelines 'Vulture Conservation Agenda' was included in the working plan of the Nilgiri North Division of Forest Department, Government of Tamil Nadu with the support of Mr. Sugirtharaj Kovilpillai, then DFO, and Mr. Kalairajan, then A.C.F., Gudalur.

Recognition

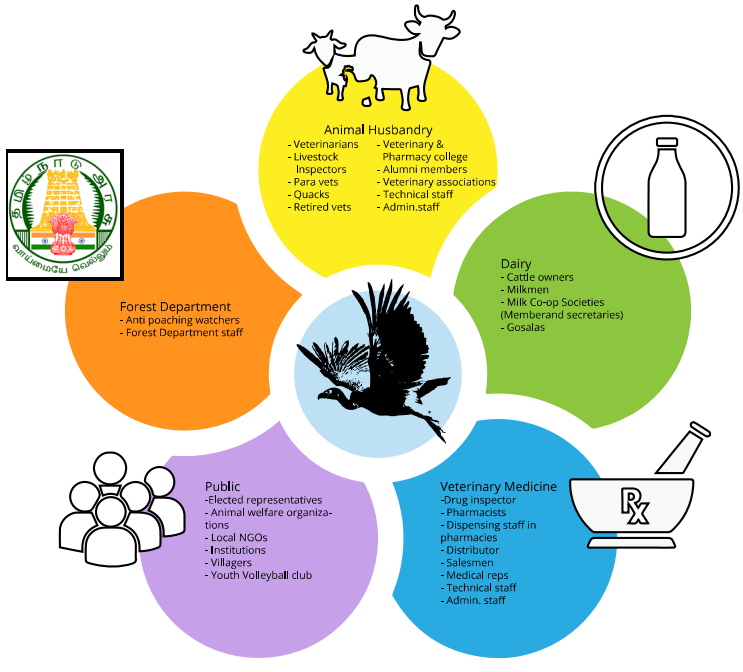
- Arulagam has been selected as Associate partner in SAVE consortium.
- Auroville Foundation, Puducherry, India has awarded Biodiversity Award in 2015 for the conservation of environment and vultures
- Arulagam's exemplary work has been recognized by International organization, Critical Ecosystem Partnership Fund (CEPF) and has selected Arulagam's Secretary, Bharathidasan Subbaiah as a Bio- diversity Hot Spot Hero in 2016
- Oriental Bird Club (OBC),UK through March Conservation Fund of Tide's Foundation, California, USA has also recognized Arulagam's work and awarded the best project award for the year 2015.

Personal level

- I myself had impleaded in the writ petition against the Multi Dose Vials of diclofenac ban issue and submitted the necessary documents to the high court of Madras. Now the court has upheld the ban
- I have presented two papers one is at Africa chapter and another one is at Asia chapter in world conservation congress in IUCN, Hawaii, 2016
- I shared my experiences in the recently held 7th SAVE meeting at Bangladesh in Nov, 20th 2017. I also have been invited to share our experience in 2014, 2015, 2016 of SAVE meeting
- I have written three books in wildlife and including a book on Vulture in Tamil.
- R.Venkitachalam awarded his Ph.D. thesis entitled "Status and Ecology of threatened Vulture Species in Moyar Valley of Tamil Nadu, India" with the support of Arulagam. This is the first scientific report on Vultures in the Nilgiri landscape.

Activities and Approach

We categorized the stakeholders into 5 groups.



Attitude Survey Conducted

We conducted a survey in the project area and asked the cattle owners the following questions.

Why was diclofenac banned? Was there a connection between vultures disappearing and diclofenac? When was the last time you used diclofenac in cattle? Which is the safe alternative drug recommended by the government? Can we use multiple dose of the human drug on cattle?

The objective of the survey was to find out the level of awareness prior to the commencement of our project. We chose the following stakeholders - the cattle owners, veterinary doctors and their likes.

A slightly different questionnaire for the drug dealers and pharmacists were asked like:

Which is the most popular NSAID? When was the last time you sold diclofenac for cattle? Are you aware of the drugs that cause harm to vultures?

Attitude and awareness survey also conducted among the professor in the Veterinary College. When we asked the question to a professor, why the drug diclofenac was banned? His reply was that he just knew that the drug was banned and he needed time to refer and get back to us as to why it was banned!

This gave us the indication of the gravity of the problem. If a professor should state he needs time to know regarding the ban, how can we expect the common man to know it?

We realised that even after 4 years of the ban, hardly very few people only knows about it and everyone should

be aware of the ban and the reason. It was indeed a tough proposition. We decided to take up the challenge and started in earnest.

Propaganda Materials developed

Based on the above inputs, propaganda prepared materials developed and printed that explained about vultures, the 4 extant species in South India, their role in the ecosystem, the status as endangered species, the cause for their decline, the steps needed to be taken to revive them and the role of people in the same.

Interaction by triggering the glorious past

memories are usually nostalgic to people and we used this aspect to start our conversation with them. We approached middle aged people and asked them when they had seen this bird last. Most of them replied that they had seen this bird in their childhood. This presented us the opportunity to open them up for further discussion. We asked if it hurt them that the bird that they once saw in huge numbers is now on the verge of extinction. We saw that this question really moved them.

We told them that Dr. Neelakandan, a bird researcher has documented that the number of vultures exceeded that of crows in Chennai in the year 1950! We presented the story of *Thirukazhugukundram*, where 2 vultures would come to consume the *prasadam* from the priest of the temple at noon everyday till about 30 years back. Now they have disappeared forever. We shared references regarding vultures that appeared in our *sangam* literature, *Kamba Ramayanam* etc and the stakeholders listened to these and shared their knowledge passionately.

The next step was to change the general perception of vultures among the public. Vultures were routinely portrayed in bad light by cartoonists and writers alike. They sought to show vultures where they wanted to show cunning, death, desolation etc. If looks are not your forte and you have bad press to boot, how could you make it to stardom? It is difficult, but possible. All that is needed is an image makeover with proper positioning. We collected data of the thankless service vultures were rendering for millions of years and how their not-so-elegant looks made them ideally suited for the role. We saw promising results in this PR activity.

We engaged them in a discussion as to where these birds have gone now and what happened to them. And then, through various means of communication such as printed materials, slogans, art and drama, we made them realise that we have inadvertently destroyed them by using harmful drugs like diclofenac on cattle and that they became critically endangered.

Pharmacists

We wanted the pharmacists to be aware of the ban and that we are following up on the ban and sent copies of the gazette notification on the ban via post and email. We hand delivered the notification as a reminder. We brought this up in the Pharmacists meet too. We also invited the drug and pharmacy association president and secretary as a chief guest in our programme and vulture conservation message delivered effectively through them.

Department of Animal Husbandry

We designed a focus group for the veterinarians and others in the field of animal husbandry and coined it 'Vet for Vultures". We connected with this fraternity through various methods such as taking part in their annual meetings, inauguration of new veterinary dispensary, Veterinary camps, events for free milch cattle distribution etc with or without invitation, mostly the latter. We utilised every opportunity to bring up the topic of the harmful drugs used on cattle killing vultures and requested them to shun the same.

I was invited by my friend Dr. Jaganmohan to his daughter's marriage. As he was a veterinarian and a lot of his fellow veterinarians would attend the function, we used the opportunity to discuss the topic of diclofenac and reminded them of the harmful effects of such drugs on vultures. We distributed pamphlets on the occasion. We have been taking part in the monthly meetings of the milk cooperative society in Sathyamangalam and imploring with them to shun diclofenac and such harmful medicines.We faced challenges in quick dissemination of the information and the temporary nature of wall posters. So we created a stencil and used it to paint on the walls of the milk society office and nearby places messages regarding the ban and the dangers of using the harmful medicines on cattle. They were quick to create and last as long as we need them to.

Public Events

We took part in the events where people gathered in large numbers namely cattle sandys, temple festivals etc by conducting exhibitions and distributing pamphlets and interacting with as many people as possible.We conducted events such as rallies, processions, street corner meetings, puppet shows, street theatre etc and created awareness among public. In spite of the lukewarm response from the people, we continued our efforts nevertheless. We have faced cynicism and acrid criticism from various people, but those only strengthened our resolve. Wherever we go, we show the video "Vanishing vultures" wherever possible.We go to places where people gather for MNREGA activities and distribute pamphlets regarding carcass poisoning and hazards of harmful medicines like diclofenac.

Motorcycle Rally

We conducted a 500 kms rally with TITA (Tiruppur Information Technology Association) starting from Tiruppur covering the 3 states of Tamilnadu, Kerala and Karnataka to spread awareness of vulture conservation and the need to shun harmful medicines like diclofenac on cattle. We distributed pamphlets, held meetings at important junctions, had interactions with cattle owners.

Vehicle: A Message bearer

On the way and displayed the messages on our vehicles too. The rally aside, our vehicle has covered more than 1,00,000 kms with the message. The display board made people curious enough to approach us wherever we park the vehicle.

Pals of Vulture

We wanted to give a positive message to the next generation praising the role of vultures and thanking them for the same. We also wanted children to know how to observe and learn from nature. We designed a unique event for vultures involving children, which is the first of its kind in the whole world. The event was named "**Gyps Carnival**". **Gyps Carnival** was focused on the theme of vulture the specialist and we portrayed their unique adaptations such as keen eyesight, unbelievable flight capability, disease resistance, enormous appetite, their harmless nature etc. We enlisted the support of the Indian Air Force and invited the wing commander to address the children. We had Air Force NCC cadets explaining the process of flight with a flight model and showed them how these would have been designed by inspiration from the birds. We conducted art competition across 4 age groups and had more than 3000 children participating in it. They learned about vultures and appreciated the bird by enthusiastically getting tattoos of vultures and masks.

Ladders Game

We took the game of *paramapadham* (snake and ladder) from our culture and developed a similar game with the theme of vulture conservation and we get children to play it in various gatherings and present vulture dolls as prize to them. (Designed the game in such a way that the game should not make a negative image on snake also).

Vulture Recovery Plan

We developed an action plan with the support of SAVE (Saving Asia's Vulture from Extinction) to bring the critically endangered species back from the brink and reached the same to the decision makers.

Vulture Trophy – Volley ball tournament

We saw that the youth in the Nilgiris love the game volley ball due to limited space. We used this for conveying the message among the youth and conducted a tournament called 'Vulture Trophy Volley Ball Tournament'. Using the public announcement system they had for commentary, we broadcast the message of vulture conservation and the effect of diclofenac, carcass poisoning, forest fire etc. at regular intervals as the spectators were our stakeholders. We enrolled them as volunteers under a group called 'Vulture Brigade'. We have been having tattoo sessions with vulture drawings to attract the youth.

Milestones

We would like to share with you some important achievements in vulture conservation. They are:

A Historic Resolution

As the Lok Sabha elections were underway, we were prohibited from using our propaganda vehicle. We had to be dormant during that time. As we were going through the newspapers, one news item caught our eye. It said that the Grama Sabha meeting held on the 1st of May every year would have to be shifted to 1st of June due to the election. We planned to use make use of this additional time of one month to get the grama sabha to pass the diclofenac ban as a resolution. It would make a huge impact as the grama sabha resolution will have far better reach to our stakeholders. *Archana Patnaik* was the collector of Coimbatore at that time. We met her and shared this idea. She had taken part in our event in Nilgiris when she was the collector of Nilgiris then. As she was aware of the precarious situation of vultures and was keen to do something to protect them, it was easy for us to convince her. She accepted our request to pass the resolution. We felt that passing it as a resolution in Coimbatore alone is not enough and we need to do the same in the other districts of Nilgiris and Erode which are part of our project area. We contacted the collector of Erode Mr. *Shanmugam*, IAS and placed the request. He too felt sad that it has become rare to see the bird nowadays. He ensured that the resolution was passed in Erode. The same resolution was then passed in Nilgiris. The then DFO of Nilgiris - *Badrasamy* IFS, and *Shankar* IAS were supportive to the cause. We sent letters to all the local elected representatives of the panchayats about the status of vultures, the need to protect them and the steps to be taken. Now we ensured that the ban on diclofenac on cattle has in fact reached the nooks and corners of our project area.To us at Arulagam, this is a milestone achievement. This is the first time a resolution has been passed to protect a species in all the three districts. This we consider a feather in the cap for our fieldwork. This made people sit up and take notice of Arulagam.

Vultures to soar again

I am sure all our efforts will ensure the revival of their population. However, they may face scarcity of food. Carcasses devoid of dangerous drugs should be made available to them by Cattle owners and forest department officials as a gesture to support the ecosystem. This will ensure not just the revival of vultures, but animals like flies like blue bottle, mynas, hyenas, wild boars and other carrion feeders. The carcasses of animals dying in and around villages are buried. This should change and we need to bring the change soon.

Animal Welfare Society

The 'Nilgiri Animal Welfare Society' kindly consented to our plea and agreed to let the carcasses of cattle that are not treated with any medicine in their gaushala to be feed by vultures. We are proud to have brought this change in attitude towards vultures.

We would like to place our gratitude to Aseervadham Trust for the support they provide by means of giving Rs. 1500/= to the bereaved cattle farmers in lieu of letting their cattle to be consumed by carrion eaters of the forest instead of burying them. We have started this activity now, but we have a long way to go.

Uncontaminated cattle grown by traditional methods

When we saw that even traces of drugs in the carcasses of cattle were enough to kill vultures when they consumed the carcasses, we were wondering what effect it will have on us when we consume dairy products albeit in the long run. After all vultures by their demise and decline

were merely announcing the dreaded message. We have started a movement by promulgating the message of organic maintenance of cattle in the Moyar region and helping the cattle owners realise better value of milk products in this process. We are eager to get your views and ideas in this movement.

Acknowledgement

We would like to record our thanks to C.Sashikumar of (Malabar Natural History Society) and Chris Bowden, Saving Asia's Vulture from Extinctions, (SAVE) Jayshree of Care Earth Trust for their cooperation in executing this project. Also we would like to thank, C. Paraman, Ms. J. Revathi, K.Sakthivel, Prakash and R. Murugesh, Co-ordinators, of Arulagam for their help in many ways. We also would like to convey our sincere thanks to K.mohanraj, M. Lenin, Raghunath Krishna, Amsa, Kalyanasundaram perumal for their volunteer contributions in many ways. At this juncture, we express our sincere gratitude to various institutions such as Tamil Nadu Forest Department, Animal Husbandry Department, Critical Ecosystem Partnership Fund (CEPF), Central Institute of Classical Tamil, Bombay Natural History Society, World Wide Fund for Nature (WWF - India), Oriental Bird Club (OBC), Royal Society for Protection of Birds (RSPB), and Hill Area Development Programme (HADP), Udhagamandalam, Ashirvadam Foundation, Mohamed Bin Zayed Species Conservation Fund, Rufford Foundation, MIVA and Tirupur Information Technology Association (TITA).

Ref;

VSZ concept of Nepal

VSZ initiative of Bangladesh

PEOPLE'S PERCEPTION ON VULTURE CONSERVATION IN TAMIL NADU PART OF THE NILGIRI BIOSPHERE RESERVE, SOUTHERN INDIA

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ABSTRACT

Vultures play an essential role in environmental health by scavenging meat from carcasses in Asian countries especially in India. Being a scavenger in habit, the vultures prevent spread of dangerous diseases such as anthrax and rabies, which could cause havoc to the wild animals, livestock and human. Therefore the vultures play vital role in the terrestrial ecosystem as a scavenger. The vulture populations from India has also undergone rapid decline that causes low awareness among people about its ecological importance. For declining species that have large range and are mostly associated with humans, people's attitudes can have direct effects on their survival because of the multiple linkages and potential for both positive and negative impacts of human behaviour for these large scavengers. Therefore, we conducted a study in Mudumalai Tiger Reserve, Nilgiri North Forest Division and Sathyamangalam Tiger Reserve in the Tamil Nadu Part of the Nilgiri Biosphere Reserve to assess the vultures' and livestock population status and human relations using questionnaire surveys respectively. White-rumped Vulture (*Gyps bengalensis*), Long-billed Vulture (*Gyps indicus*), Red-headed Vulture (*Sarcogyps calvus*) and Egyptian Vulture (*Neophron percnopterus*) were commonly found in this regions. Totally three hundred and ninety-one livestock holders were interviewed in twenty-six hamlets. Of which most of them were tribal (Irrular) and illiterate (53%; n=213). A total of 8531 livestock were recorded. Of which cattle were dominant (n=3621). The livestock holders were making money mainly from dung (Rs.35,12,000/annum). Totally 8191 livestock were lost by 391 people during the past five years. Of which, most of them (n=5631) were lost due to various diseases and considerable (n=2548) amount of livestock were lost due to wild animal's depredation. This was an important outcome of this present project envisaged that the need of adequate and timely compensation/exgratia to the livestock holders in order to curtail poisoning of carcasses as retaliatory killing. Most of the (n=217) livestock owners were just thrown away their livestock carcasses into the forest areas not far away. On the other hand, 174 respondents have buried their dead livestock carcasses. These two findings are a valuable outcome of this present project to initiate food security to vultures through the proper long-term mechanism. The information on diclofenac in relation to vulture conservation was interviewed to the livestock holders. The result revealed that a considerable number (n=137) of people known about diclofenac at the same time most of them (n=254) were not aware of diclofenac and its related issues. A sizable amount of respondents knew that the diclofenac is a pain killer (n=91) and it is an ordinary drug (n=46). It was very important to note that most of the livestock holders (n=84) thinks that the diclofenac is harmful to vultures and similarly good amount (n=53) of livestock holders were opined that the diclofenac is not threat to vulture population. Out of 391 persons, 339 of them were opined that vultures does scavenger role in the forest ecosystem. The majority of the people (n=313) responded that the vulture population is declining when compared to past few years. Another notable conservation problem is that the feral dog's population has increased considerably when compared to past decade. This was mainly due to the availability of livestock carcasses as they were thrown very near to forest boundary. This present study found that almost all of them (n=386) were accepted the need of education for vulture conservation. It was unfortunate to note that most of them (n=388) were opined that the compensation amount paid by the forest department was inadequate and long procedures to be followed which consume more time to get the compensation. Therefore this present study emphasizes that long-term monitoring mechanism to be initiated to win the confidence of livestock holders against retaliatory killings.

Key Words: People's Perception, Vulture Conservation, Tamil Nadu, Nilgiri Biosphere Reserve and Southern India.

INTRODUCTION

Vultures of the genus Gyps are obligate scavengers on the carcasses of dead vertebrates; most commonly wild and domesticated ungulates. There are nine species of vultures recorded in the Indian sub continent namely King vulture (*Sarcogyps calvus*), Cinereous vulture (*Aegypius monachus*), Griffon vulture (*Gyps fulvus*), Himalayan Griffon vulture (*Gyps himalayensis*), Long-billed vulture (*Gyps indicus*), Slender-billed vulture (*Gyps tenuirostris*), White-rumped vulture (*Gyps bengalensis*), Egyptian vulture (*Neophron percnopterus*), and Bearded vulture (*Gypaetus barbatus* (Ali, 1995; Birdlife International 2007; Gadhvi and Dodia, 2006; Parsi, 2009). The decline (>95%) of the *Gyps* vultures was first recorded in Keoladeo Nation Park, Rajasthan (Prakash, 1999). Throughout the Indian subcontinent, populations of oriental white-backed vulture (*Gyps bengalensis*), long-billed vulture (*Gyps indicus*) and slender-billed vulture (*Gyps tenuirostris*) declined rapidly, beginning in the 1990s (Gilbert *et al.* 2006 , Prakash *et al.* 2007 , Chaudhary *et al.* 2012) and are now listed as 'Critically Endangered' (IUCN 2011). A wide range of evidence has established that veterinary use of diclofenac, a non-steroidal anti-inflammatory drug (NSAID), is the main cause of these population declines (Green *et al.* 2004

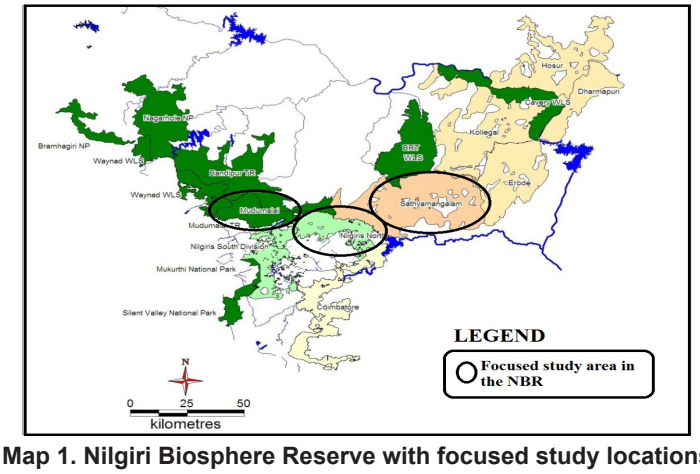
, Oaks *et al.* 2004 , Shultz *et al.* 2004). Vultures are exposed to diclofenac when they feed upon carcasses of domestic ungulates treated with this drug shortly before death. Conservation efforts in India have included research and captive breeding programs (Prakash *et al.* 2003, Umapathy *et al.* 2005, MoEF 2006).

In southern India there are seven species of vultures namely White-rumped, Long-billed, Red-headed, Egyptian, Himalayan Griffon, Eurasian Griffon and Cinereous vultures (Sashikumar, 2001; Davidar & Davidar, 2002; Thejaswi, 2004; Subramanya & Naveen, 2006; Davidar, 2007; Umapathy *et al.*, 2009; Ramakrishnan *et al.*, 2010, 2012 & 2014 ; Praveen *et al.*, 2014; Samson *et al.*, 2014a,b ; Venkitachalam & Senthilnathan, 2015; Venkitachalam & Senthilnathan, 2016; Samson *et al.*, 2015; Samson and Ramakrishnan, 2016a,b; Samson *et al.*, 2016a,b,c) were recorded.

The Tamil Nadu part of the Nilgiri Biosphere Reserve (Mudumalai Tiger Reserve, Nilgiri North Forest Division and Sathyamangalam Tiger Reserve) harbors four species of vultures seen commonly (Samson *et al.*, 2014a,b). The past studies clearly exposed that the Diclofenac plays a critical role for declining vulture population across the country. On the contrary Ramakrishnan *et al.* (2010) found that the Diclofenac was not a culprit for declining vulture population in the Moyar Valley which is a part of the Nilgiri Biosphere Reserve. It is need of the hour to ensure that is there any chance of diclofenac usage in livestock practice at landscape level. According to the literatures micro level usage of diclofenac more than enough cause havoc vulture population. Therefore this study was attempted to assess the livestock estimation, carcasses disposal mode, knowledge on diclofenac and mindset on vulture conservation.

STUDY AREA

The Nilgiri Biosphere Reserve (NBR) is the first and foremost biosphere reserves established in the year 1986 in India. The reserve is situated in the Western Ghats, in the Nilgiri Hills range of South India and is considered as an International Biosphere Reserve. It was declared under the Man and Biosphere Programme (MAB) of UNESCO and is also under consideration by the UNESCO World Heritage Committee for selection as one of the World Heritage Sites. The reserve encompasses 5,520 km² surrounded by Karnataka (1527.4 km²), Kerala (1455.4 km²), and Tamil Nadu (2537.6 km²) states. The Biosphere lies between 11o 36' to 12o 00' N Latitude and 76o 00' to 77o 15' E Longitude. Central location: 11°30'00 N, 76°37'30 E The NBR has protected areas namely, Mudumalai Tiger Reserve (321.1 km²), Sathyamangalam Tiger Reserve (745.9km²) Wayanad Wildlife Sanctuary(344km²), Bandipur Tiger Reserve (874km²), Nagarhole Tiger Reserve (643 km²), Nugu Wildlife Sanctuary, Mukurthi National Park (78 km²) and Silent Valley National Park (89.52km²). This reserve also includes Nilgiris North Division (448.3 km²) and Nilgiris District, South Division (198.8 km²) and Coimbatore Division (696.2 km²) in Tamil Nadu (Map1). The reserve extends from the tropical moist forests of the windward western slopes of the Ghats to the tropical dry forests on the leeward east slopes. Rainfall ranges from 500 mm to 7000 mm per year. The reserve encompasses three eco-regions, the South Western Ghats moist deciduous forests, South Western Ghats montane rain forests, and South Deccan Plateau dry deciduous forests. The Nilgiri Biosphere Reserve is very rich in plant diversity. About 3,300 species of flowering plants of which 1232 are endemic to the Nilgiri Biosphere Reserve. The fauna of the Nilgiri Biosphere Reserve includes over 100 species of mammals, 350 species of birds, 80 species of reptiles and amphibians, 300 species of butterflies and innumerable invertebrates. Of the vertebrate species recorded, 39 species of fish, 31 amphibians and 60 species of reptiles are endemic to the Western Ghats also occur in the Nilgiri Biosphere Reserve. The NBR is one of the critical catchment areas of peninsular India. Many of the major tributaries of the river Cauvery like the Bhavani, Moyar, Kabini and Chaliyar, Punampuzha, etc., have their source and catchment areas within the reserve boundary. The forests of NBR are spread over a vast area and cover various ecotypes. The overall classification of the different forest types are as follows: Evergreen, Semi-Evergreen, Moist Deciduous, Southern Montane Wet Temperate, Dry Deciduous, Dry Scrub Woodland, Grasslands and Evergreen Forest. This study was conducted in Mudumalai Tiger Reserve, Nilgiri North Forest Division and Sathyamangalam Tiger Reserve in the Nilgiri Biosphere Reserve, Southern India



Map 1. Nilgiri Biosphere Reserve with focused study locations

MATERIALS AND METHODS

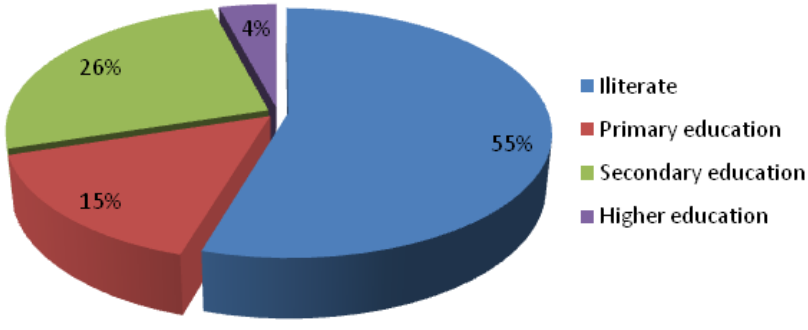
The study was aimed to explore the people perception on vulture conservation in was assessed through a questionnaire survey in the Tamil Nadu part of the Nilgiri Biosphere Reserve**.** Two sets of questionnaire were developed for this study. On was “Precise and Closed” and other one was “Broad and Open ended. The people in this plateau has more literate, so the questionnaire was prepared to understand easily and the questions were asked in local language for easy communication. The respondents were briefed about the purpose of the visit and verbal consent was taken for voluntary participation in interviews. At least one adult (≥ 18 years old) was interviewed in his/her residence. Face to face interviews were made it easier to clear any ambiguity had about the question.

The questionnaire had two sets of information i.e name, education, occupation, year of living etc. were collected by using “Precise and Closed” from the respondents.. This set of questions had asked for direct answers form the respondent (Ramakrishnsn .2008).Second set of information was collected through “ Broad and Open ended” questions giving the respondent an opportunity to express his her views freely without and inhibition (Balakrishnan and Ndhlova, 1992, Ramakrishnan, 2008). Totally 391 livestock holders were interviewed for this study.

RESULT

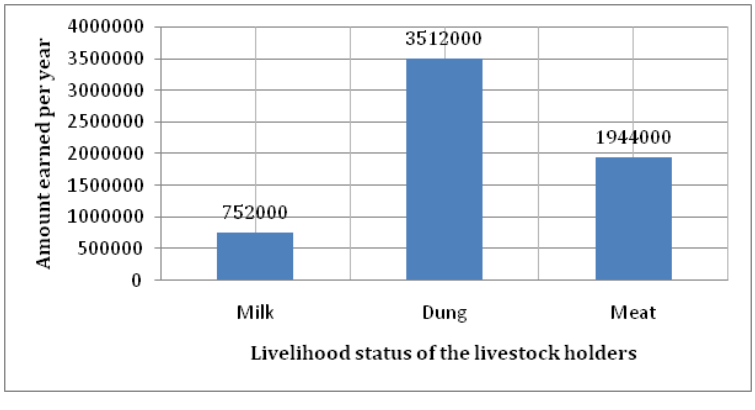
Totally 391 livestock holders were surveyed in 26 hamlets and result recorded a total of 8531 livestock. The cow was dominant (n=3621) followed by goat (n=2959), sheep (n=1212) and buffalo (n=739). The Sugilkuttai village attributed the maximum number of livestock (n=836) followed by Thengumarahada (n=689) and Achakarai (n=549) hamlets. Anaikatti, Masinagudi, Mavanalla, Moyar, Halli Moyar and Semmanatham villages held 400+ livestock. The least number of livestock population was observed in Yanna padi (n=5) which is located in the core area of Mudumalai Tiger Reserve (Table 1). Out of 391 respondents most of them were belonged to the tribal community (n=281) while a large number (n=110) were non-tribal. Male category was more (n=233) than the female (n= 158). The average age of the male respondents were 48.27±(1.12) and the female respondents were 47.91±(1.28). The literacy profile of the respondents revealed that more than half were illiterate (53%; n=213). A sizeable number of people were holding Secondary education (5th STD to 10th STD) (26%; n=101) and Primary education (1st STD to 5th STD) (15%; n=61). Very few of them (4% (n=16) completed their Higher education (12th STD to Degree) (Fig. 1).

Figure 3. Education profile of the livestock’s holders



Livelihood status of the livestock holders was determined. Results showed that for most of them (n=241) were depending livestock was their only source of livelihood. On the contrary, considerable number (n=150) of them said they earned from other sources i.e., agriculture labour. The livestock holders made money mainly from sale of dung (Rs.35,12,000/-) followed by meat (Rs. 19,44,000/-) and milk (Rs.7,52,000/-). 391 persons earned about Rs. 62,08,000/-

Figure 2: Income status of the livestock holders from livestock:



Totally 8191 livestock were lost by 391 people during the past 5 years. Most of the livestock (n=5631) were lost due to various diseases and considerable amount (n=2548) of livestock were lost due to wild animal predation. On average about 1638.2 livestock had been lost every year. Approximately, 1126.2 deaths were due to diseases and 509.6 individuals by wild animal predation in a year. Methods of livestock carcasses disposal were obtained from 391 livestock holders. Most of them (n=217) responded that they just threw away the livestock carcasses into the forest areas. On the other hand, 174 respondents said they buried their dead livestock carcasses (Fig 5).

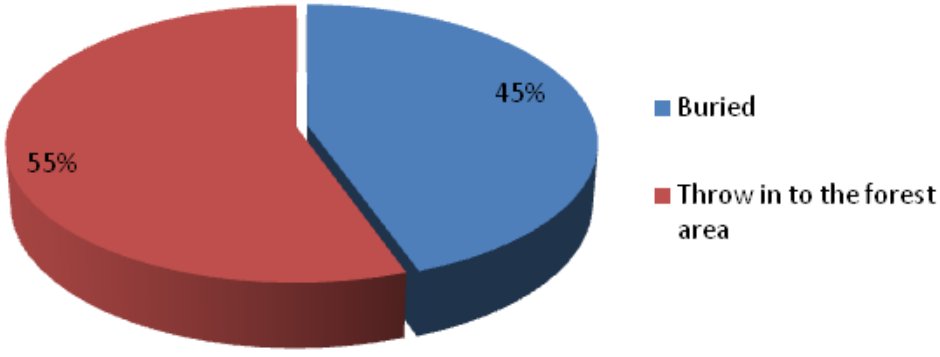


Figure 5: Mode of livestock carcasses disposal

The information on Diclofenac in relation to vulture conservation was obtained in interviews with livestock holders. The result revealed that a considerable number (n=137) of respondents knew about Diclofenac but at the same time most of them (n=254) were not aware of Diclofenac-related issues. A sizable number of respondents (n=91) and (n=46) knew that the Diclofenac was a pain killer and drug respectively. It was very important to note that most of the livestock holders (n=84) thought that the Diclofenac was harmful to vultures while a sizeable number (n=53) said that the Diclofenac was not threat to vulture population (Table 2). Totally 391 livestock holders were interviewed during the study period. It was a positive sign that most of the respondents had some knowledge about vultures (n=387). Out of 391 persons, 339 of them opined that vultures played the role of scavengers in the forest ecosystem. The majority of the people (n=313) responded that the vulture population was declining as compared to past few years. Respondents had accepted that vultures were beneficial to humans (n=370). An important issue to note was that the stray dog population had increased as compared to the past 10 years as per information gleaned from 347 respondents. Almost all of them (n=386) agreed that education on vulture conservation is warranted (Table 3).The status of compensation/ex gratia received by the livestock holders from the forest department was obtained. Although the compensation was recently increased by Tamil Nadu Forest Department the payment was still a lengthy process that resulted in delays as told by livestock holders (n=388).

DISCUSSION

The present study recorded that recorded that the cattle population was higher in our study area in twenty-six surrounding villages. The villagers keep livestock mainly for dung followed by meat and milk. There is a high demand of dung from upper Nilgiris inhabitants for mushroom culture, tea and coffee plantations. Silori and Mishra (1995) called this cattle as “Dung producing machine” in and around Masinagudi Village of the Sigur plateau. The statement of Silori and Mishra, (1995) was now evidenced by dung sale cost ofRs. 35,12,000/- per annum by 391 livestock holders in the study villages. It was quite interesting to note that Rs. 19,44,000/- was earned by selling their livestock to the butchers for slaughter houses. This is mainly because of the adjoining state of Kerala where the people consume both cattle and buffalo meat. Hence the selling cattle for meat was in second position followed by sale of milk. The milk production was the very low (Rs. 7,52,000/-) because of the scrub cattle are a country breed which produces lower quantity of milk, unlike cross breed varieties. The reserve forests are considered to be common pool resources which cattle owners enjoy at low-cost investment. This study has confirmed that most of the livestock carcasses (55%) were thrown out and made available for natural disposal and remaining (45%) of them were buried. Unfortunately, these carcasses were not thrown far away from the villages. They were thrown between 300 to 500 meters around the villages. Due to disturbances, these carcasses were not accessed by vultures. On the other hand, these carcasses were heavily utilized by wild boars and stray dogs. It was evidenced by the increase of stray dogs population in the villages thus resulted in behavioral change and health risks of human beings when they closely associated with them (Cunningham *et al.*, 2003; Pain *et al.*, 2003).

The carnivores’ depredation on livestock was recorded through a questionnaire survey. Although tiger, leopard, and wild dogs are reasons for loss of cattle attacks by the former were high on cows, bulls and buffalos. Ullas Karanth (2003) stated that livestock is the easiest prey for tigers when the cattle graze inside the forest areas. Leopards and wild dogs fed on goat, sheep and calves of cows and buffalos. Carcasses of wild dogs were quickly consumed by wild dog packs so were not available to vultures. Similarly, leopards hid their prey remain in branches of trees which were nor accessible to vultures. So most of the food for

vultures were obtained from tiger kills including lifestock that died natural deaths and from diseased animals. It is quite interesting to note that this landscape arguably holds the highest tiger population in the country. Therefore, the vultures in this landscape is heavily dependent on tiger kills and that are not poisoned by livestock owners in retaliation. This study found that most of the livestock holders were illiterate and depended on livestock as their major livelihood. Awareness about the Diclofenac and its effects on vulture populations was very poor. On the other hand knowledge on vulture's importance and their role in the ecosystem was well known by the livestock holders. The livestock holders opined that the vulture population is declining in their area. Generally, the livestock holders treat their injured livestock by traditional methods and sometimes they bring veterinary doctors or quacks only for extreme cases. The questionnaire survey from the veterinary doctors revealed that they use Melaxicum as a painkiller (a safe drug for vultures). It was gleaned from the vulture mortality records also. So far none of the vulture deaths were scientifically or clinically proved to be caused by Diclofenac, and instead attributed to poisoning of the carcass (Laboratory Report is enclosed as Annexure-I). Hence this study strongly suggests that education is needed for the livestock holders to change their attitude towards retaliatory killing. A similar effort has to be made to the forest department also in order to ensure adequate and quick payment of compensation/ exgratia to the livestock holders to stop the further poisoning of the carcass, which is considered as a severe threat to this vulture population rather than Diclofenac. Davidar (2002) reported that the retaliatory killing activity of livestock holders was the reason for declining of Tiger and vultures in the Sigur Plateau followed by Ramakrishnan *et al* (2010) stated that the Diclofenac is not a culprit for declining vulture population in this region as the vultures feeding on wild carcasses (including tiger killed livestock) as their major diet. This present study revealed that most of the livestock holders are illiterate and they do not aware about the Diclofenac and their uses. But they were known about the vulture conservation in forest ecosystem. The present study have been supported that a positive conservation altitude is the key for garnering local support for vulture conservation. Education campaigns, such as street theatres and allocating posters in local languages stress forecast and threats of vulture conservation, should be performed to explain the general public. These programmes may improve the awareness of people to a broad range of the values of vultures. Another significant approach would be to educate livestock holders, farmers and veterinary personals on the negative effects of Diclofenac and on the suitable throwing away of contaminated carcasses. Green et al (2004) stated that based on demographic modeling, it has been establish that less than 1% of lethal level of diclofenac can reason a hasty population crash to vulture. Therefore, educating livestock holders, farmers and veterinary personnel may help to secure healthy food for vulture. A long-term solution would be the incorporation of environmental education in school and colleges and to pay more compensation for securing the country's southern most vulture population.

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Table 1. Livestock population in and around vulture nesting colonies

S.No	Name of the hamlets	Total number of livestock holders	Livestock population				Total
			Buffalo	Cow	Goat	Sheep	
1	Achakarai	12	135	254	39	121	549
2	Anaikatty	11	212	226	-	-	438
3	Bothanathham	2	-	182	-	-	182
4	Chokkanalli	3	-	52	-	-	52
5	Kovil Patti	7	-	100	34	79	213
6	Kurumbar Padi	26	-	179	62	19	260
7	Kurumbar Pallam	16	-	61	99	22	182
8	Masinagudi	17	61	317	32	-	410
9	Mavanalla	25	-	199	185	36	420
10	Moyar	29	-	361	61	-	422
11	Semmanatham	13	90	152	148	70	460
12	Singara	5	-	68	18	-	86
13	Siriyur	9	72	231	10	50	363
14	Takkal	10	3	140	101	13	257
15	Thodulangi	23	-	17	237	101	355
16	Vazhaithottam	10	-	234	-	55	289
17	Yanna Padi	3	-	5	-	-	5
18	Hallli Moyar	21	-	131	239	82	452
19	Keezh.kalampalayam	12	-	120	175	58	353
20	Mel.kalampalayam	17	-	90	128	6	224
21	Gulithoraipatti	12	3	75	175	13	266
22	Puthukadu	22	-	25	273	11	309
23	Boothikuppai	12	-	46	123	27	196
24	Sithirampatti	18	27	17	153	66	263
25	Sugilkuttai	19	43	207	340	246	836
26	Thengumarahada	37	93	132	327	137	689
	Total	391	739	3621	2959	1212	8531

Table 2. Livestock holder's knowledge on Diclofenac

Total number of respondents	Diclofenac knowledge among respondent		What is Diclofenac		Diclofenac is harmful to vultures	
	Yes	No	Painkiller	Drug	Yes	No
391	137	254	46	91	84	53

Table 3. Livestock holders knowledge on vulture conservation

S.No	Questions asked to the livestock owners/managers	Respondents (n=391)	
		Yes	No
1	Do you Know vultures?	387	4
2	Vultures are doing scavenger roll in the environment?	339	52
3	Is vulture declining in your area?	313	78
4	Vultures are beneficial to humans?	370	21
5	It is important to educate vulture conservation to the people?	386	5
6	There are more stray dogs than before?	347	46

RESEARCH AND SURVEY OPERATION BY ENGAGING VULTURE WATCHERS IN THE NILGIRIS NORTH FOREST DIVISION, TAMIL NADU

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ABSTRACT

Vultures are valued for their ecological, social and cultural significance. Vultures scavenge on animal carcasses/ carrion, thereby helping clean environment and water resources. Vultures provide prime ecosystem services as top cleaners in cities, villages, and countryside. It was noticed back in the nineties that vultures were disappearing from the landscapes, skies and rotting carrions were not being attended by these scavengers. Vultures have appeared to be one of the fastest declining bird species in the world. Although captive breeding is under practice in north India, conservation of our country's southernmost wild viable vulture population in the Nilgiris is highly need of the hour. Considering the lacunae this research and survey operation was carried out by engaging vulture watchers in the Nilgiris North Forest Division under the centrally sponsored scheme of Project Tiger Buffer Zone Area works through the Department of Zoology & Wildlife Biology, Government Arts College, Udhagamandalam for a period between April 2016 and March 2017. Nesting sites were regularly monitored by the tribal vulture watchers.

Although this present study was supposed to look only for two nesting colonies, we had extended our survey and monitoring for seven nesting colonies used by two vulture species namely White-rumped (four nesting colonies) and Long-billed vulture (three nesting colonies). This present survey has recorded and monitored a total of 59 White-rumped vulture nests Of which the Jagalikadavu nesting colony has recorded maximum number of nests (n=31) Two tree species namely *Terminalia arjuna* (36 trees with 54 nests) and *Spondias mangifera* (one tree with 3 nests) were used for nest construction by White-rumped vultures. Among the 59 nests, 37 nests were recorded as active nests evidenced by frequent usage of nesting pairs. Out of 37 incubations, 21 hatchlings were came out with 56.8% of breeding success. Similarly this present survey has recorded five number of Long-billed vulture nests in three nesting colonies. Of which the Nilgiris Eastern Slope nesting colony had highest number of nests. Among five nests, four of them were recorded as active nests. Of which three hatchlings were came out from four incubations with 75% of breeding success. Although plenty of cattle deaths were found this year due to severe drought in this region, the breeding success of White-rumped vultures was about 50% only. Therefore this present study emphasizes that long-term monitoring is highly warranted to secure this population in this landscape.

Key Words: Research, Survey, Vulture, Watchers, Nilgiri Biosphere Reserve

Introduction

An ecosystem is deemed to be stable if it has different levels of organisms in their ecological niches without which it is considered to be an unbalanced state. Trouble to any of such organisms not only leads to the collapse of the food chain but also it makes disorder in the existing food web (Green *et al.*, 2004). It is noteworthy to mention that the scavengers occupy an imperative and last level of the food chain without which the recycling or proper disposal, especially that of dead and decaying materials will be either stopped or delayed. The vultures are important link in the food chain, being a scavenger in habit, and are preventing spread of dangerous diseases such as anthrax and rabies (Prakash *et al.,* 2003), which could cause havoc to the wild animals, livestock and human. Therefore, it is believed that their absence can lead to a grave crisis in the terrestrial ecosystem (Verner *et al.,* 1986). The vultures are excellent scavengers of dead bodies and their status is critically tagged with the present situations (Mandel *et al.,* 2008).

Among the threatened birds, vultures, especially *Gyps* species facing radical population crash in the country (Prakash, 2001). Well protected forests and the adjoining rural areas in the country had *Gyps* vultures as very common two decades ago are now catastrophically declined especially the White-rumped and Long-billed vultures throughout India (Prakash, 2001). Only few protected areas in the country are having small, significant and fragile population of *Gyps* vultures. The reason for the population crash of the *Gyps* vultures in the Indian subcontinent has been identified that the drug called "Diclofenac", a Non-Steroidal Anti-Inflammatory Drug (NSAID) used in veterinary practice as a culprit in Pakistan, India and Nepal. Oaks *et al.* (2004) first discovered and described that the *Gyps* vultures died due to renal failure when they ingested the drug diclofenac from the tissues of domestic livestock carcasses.

There are nine species of vultures found in the Indian Subcontinent. Of which, four of them are found in south India namely Egyptian Vulture (*Neophron percnopterus),* Red-headed Vulture (*Sarcogyps calvus),* White-rumped Vulture (*Gyps bengalensis)* and Long-billed Vulture (*Gyps indicus).* There has been a catastrophically decline in the populations of three species in the Indian subcontinent, White-rumped vulture, Long billed vulture and Slender billed vulture (Green *et al.*, 2007; Prakash *et al.*, 2003). Red headed vulture has also declined in the Indian subcontinent including Nepal (Cuthbert *et al.*, 2006) believed to be primarily due to diclofenac (Green *et al.*, 2004; Meteyer *et al*, 2005; Cuthbert *et al.*, 2006; Swan *et al.*,2006; and Naidoo *et al.*, 2010). This has resulted in the reclassification of this species to Critically Endangered (IUCN, 2012). Egyptian vulture is a

long lived species, which are classified as endangered because of their rapid population crash in India and Nepal (Cathbert *et al.*, 2006). However other causes such as habitat destruction, food shortage, human persecution, poisoning and pesticide use also have caused a gradual decline in vulture populations (BirdLife International 2001). According to the Birdlife International (2008) the decline rate of three *Gyps* vultures in the Indian subcontinent have occurred at least 48% every year. The critically endangered and endangered species may disappear if immediate scientific management efforts are not initiated. In south India, such scientific management activities are handicapped due to lack of strong scientific research findings. Therefore this present research and survey operation was carried out by engaging vulture watchers in the Nilgiris North Forest Division under the Centrally sponsored scheme of Project Tiger Buffer Zone Area works by the Department of Zoology & Wildlife Biology, Government Arts College, Udhagamandalam for a period between April 2016 and March 2017.

Study Area

The Nilgiri North Forest Division lies between the North latitudes 11.14'35.26", 11.36'60" and the East longitudes 76.31'52.86", 77.00'56.35". The geographical area of this division, consisting of forest and areas other than forests, is situated in Udhagamandalam, Coonoor, Gudalur and Kotagiri Taluks of the Nilgiris Revenue district. The total geographical area of this division is 543.32 Sq.Km. The division forms part of the internationally famous "Queen of Hills - The Nilgiris" and attracts tourists from all over the world throughout the year. This division is bounded on the North by the state of Karnataka and Talamalai Range of Sathyamangalam Tiger Reserve, where Moyar river forms the common boundary, on the East by Bhavani Sagar Range of Sathyamangalam Tiger Reserve, Erode District, in the southeast by Sirumugai Range and South by Mettupalayam Range of Coimbatore Reserve Forest Division of Coimbatore District. On Southwest and West it is bounded by The Nilgiris South and Gudalur Reserve Forest Divisions and on the northwest by Mudumalai Tiger Reserve within the Nilgiris District. It also forms part of The Nilgiris Biosphere Reserve, which is the UNESCO recognized first and foremost biosphere reserves of the country. The terrain of this division exhibits quit diverse configuration with a significant range of variation in altitude and vegetation. There are lot of valleys and plateaus in the tract now dealt with. The terrain of the division may be divided into three naturally distinct region which show variations in altitude and vegetation due to varying topographic, climatic and edaphic factors with forms the basis for rich biodiversity, wildjjplife richness and good weather. The regions are The Nilgiris Plateau, Sigur Plateau and Outer Slopes. The climate of the Nilgiris plateau is temperate. The mean month temperature varies between 16 ºc (May) to 11 ºc (December) the general temperature is equable shade with lesser diurnal variation, the average annual variation for the Nilgiris plateau. The maximum 21 ºc to 25 ºc and the minimum 10 º to 12 ºc in summer. During winter the maximum is 16 ºc to 21 ºc and the minimum is being of 2 ºc. At Coonoor the maximum and the minimum temperature is 27 ºc (July) and 9 ºc (January).

Materials and Methods

Population Estimation

Nest site count

A questionnaire survey was conducted to the local people and forest field staff in order to find out roosting and nesting colonies of vultures at the initial stage of the project. Once it was confirmed the monitoring was done twice in a month by vulture watchers to count all vultures under the guidance of the Principal investigator in the nesting colonies. Although only two nesting colonies were supposed to monitor as per the proposal, nevertheless seven nesting colonies were monitored from 1st April, 2016 to 31st March, 2017. The population size of each vulture species was counted at each nesting colonies in early morning (0630 to 0930 hrs.) and late evening (1730 to 1930 hrs.) by foot walk as described by Baral (2005). The nesting and roosting colonies were thoroughly searched for dead vultures to estimate mortality rate. Although four vulture species namely White-rumped, Long-billed, Red-headed and Egipsian vultures are frequently seen in the Nilgiri North Division, nesting colonies were recorded for only for two species namely White-rumped and Long-billed vultures so far. Therefore nesting and breeding ecology were confined only for these two vulture species.

Breeding ecology of two vulture species

Each nesting colony was visited twice in a month. All observations were made using binoculars (Nikon 52×10) from an appropriate distance (100-300m) to nesting colonies. Focal animal sampling method was used to record breeding ecology of two vulture species in nesting colonies (Postupalsky, 1974; Acharya *et al.*, 2009; Awan *et al.*, 2017). Ten minutes was spent for each observation for each nest as focal sampling time in a day. The observations were made from 7.00am to 12.00noon. Active nests were identified by the presence of fallen nesting materials, feathers and white wash (excreta) below the nesting tree or incubation of vultures in the nest **.** All the nests were identified and nesting trees were tagged and monitoring for future concern (Postupalsky, 1974). Nest exposure direction towards sunlight on the nesting trees as well as rocks was calculated using compass. Nesting locations viz either on the top of the tree or crown and limb (Offshoot growing directly out of a tree trunk) was estimated by visual estimation. Confirmation of active (occupied) and abandoned (unoccupied) nest was identified based on the criteria laid down by Postupalsky (1974). An active breeding pair was defined as with the presence of an egg in the nest. Non-breeding pair was one that occupied the nest at least for three week visits, but did not laid an egg. Breeding success was calculated from the number of fledglings fledged out divided by the number of breeding pairs. Successful fledged out from incubation was confirmed by whether two adult vultures were observed at the nest, one standing nearby and one on incubation or only one was on incubation or one adult with chick or a young chick alone was present in the nest. Information on mortality, especially of adult mortality was recorded at nesting colonies (Baral *et al.,* 2005; Steenhof & Newton, 2007). Finally an active nest was considered if it was occupied by at least an egg was presented in the nest (Xirouchakis and Mylonas, 2005).

Result

Population details

The population status of White-rumped Vultures at 4 nesting colonies the Jagalikadavu nesting colony recorded a maximum number of individuals (73.29±3.08) as well as adults (47.95±2.71) and immatures (25.95±0.09) followed by Anaikatty Nesting Colony (48.91±1.78), Ebbanad (31.54±1.07) and Siriyur nesting colonies (1.29±0.35). Long-billed Vulture population was high in Nilgiri Eastern Slopes nesting colony with the maximum number of population (5.08±0.36) as well as adults (3.16±0.22) and immature (1.91±0.19) followed by Kallampallayam nesting colony (2±0.17) and Ebbanad nesting colony (2±0.12)

Breeding Ecology

White-rumped Vulture

A total 59 nests in 34 nesting trees of White-rumped vulture was recorded in four nesting colonies altogether. Maximum number of nests (n=31) as well as nesting trees (n=19) were recorded in the Jagalikadavu nesting colony followed by Anaikatty nesting colony (17 nests in 7 nesting trees), Ebbanad nesting colony (9 nests in 6 nesting tress) and Siriyur nesting Colony (2 nests in 2 nesting trees). There were only two tree species preferred by the White-rumped vultures to construct their nests in all four nesting colonies. Of which *Terminalia arjuna* (33 trees with 59 nests) was highly preferred tree species than *Spondias mangifera* (one tree with three nests).Among 59 nests**,** 37 nests were observed as active nests evidenced by frequent usage of nesting pairs. The Jagalikadavu nesting colony has been recorded the maximum number of active nests (n=21) as well as abandoned nests (n=10) followed by Anaikatty nesting colony (10 active nests and 7 abandoned nests), Ebbanad nesting colony (6 active nests and 3 abandoned nests) and Siriyur nesting colony (only 2 nests and both of them were abandoned).

The breeding success was calculated from a total number of fledglings divided by a total number of nests seen under incubation. Overall 56.8% of breeding success was recorded in all four White-rumped vulture nesting colonies altogether. Among the four nesting colonies, Jagalikadavu nesting colony was recorded highest (71.4%) breeding successes followed by Ebbanad nesting Colony (66.7%) and Anaikatty nesting colony (30%). No incubation, no hatchlings and none of the fledglings was recorded in the Siriyur nesting colony during this year.

Long Billed Vulture

A total of five nests were recorded in three nesting colonies of Long-billed vulture on rocky slopes in the study area. Of which four of them were active nests concluded by frequent usages of nesting pairs. Nilgiri Eastern Slope nesting colony has recorded the maximum number of active nests (n=2) as well as abandoned nest (n=1). The Ebbanad Valley and Kalampalayam has recorded just one active nest respectively.

Among the five nests, there were four nests were seen under incubation for Long-billed vulture in the Nilgiri North Forest Division. Totally 75% of breeding success was recorded in three Long-billed vulture nesting colonies altogether. Of which, the Nilgiri Eastern Slopes (2 incubations seen with 2 hatchlings and 2 fledglings) and Kalampalayam nesting colonies (1 incubation seen with 1 hatchling and 1 fledgling) were observed 100% of breeding success. Although only one incubation was noticed in Ebbanad Valley nesting colony 0% breeding success was recorded which means no fledgling or hatchling was seen from one nest.

Discussion

Among the vulture species, the decline to *Gyps* vulture population was alarming in the Indian subcontinent involving high mortality rate and breeding failures (Prakash, 2001). It is likely to lead to their extinction if the problems are not urgently addressed (Birdlife international, 2001). Hence, this present research and survey operation was taken up in the Nilgiri North Forest Division, Tamil Nadu under the Centrally sponsored scheme of Project Tiger Buffer Zone Area works through the Department of Zoology & Wildlife Biology, Government Arts College, Udhagamandalam for a period between April 2016 and March 2017 in order to protect our country's southern most wild viable vulture population. Although this project supposed to look only two nesting colonies, but seven nesting colonies were looked after on two critically threatened vulture species namely White-rumped (*G.benghalensis*) and Long-billed Vultures (*G.indicus*) on the aspects of population status, nesting ecology, breeding success and usage of diclofenac and others.

Out of seven nesting colonies, four of them were used by White-rumped and three by Long-billed vultures. We found that the nesting colonies were located nearer to human habitations. Previous literature were also supported that the location of breeding Colonies near to human habitation in Nepal and Gujarat (Baral *et al.*, 2005; Baral and Gautam, 2007; Dave, 2011; Harris, 2013).

This present study has observed that there is a fluctuation in population estimation of White-rumped vulture numbers ranging between 40 and 91 in Jagalikadavu, 1 and 5 in Siriyur and 25 and 60 in Anaikatty and 20 and 38 at Ebbanad nesting colonies. A similar trend was also been noticed for Long-billed vulture population in all three nesting colonies areas viz. 1 and 3 in Ebbanad, 2 and 8 in Nilgiri Eastern Slopes and 1 and 3 at Kalampalayam nesting colonies. The vulture populations were very less in the month of June was gradually increased and reached its maximum numbers at the end of May. A similar pattern was also noted by Baral *et al.* (2005) for White-rumped vulture population in Nepal and by Changani and Mohnot (2004) in Rajasthan. This was mainly because of the adults flew far away from the nesting colonies in search of food and sometimes they spend overnight or even one or two days if they get food during non-breeding seasons. But they confine its range for food from where they could come back to their nests to continue parental care and feed their young ones during breeding seasons. Therefore the maximum number of vultures were seen in and around nesting colonies mainly during active breeding season (incubation, hatchlings, fledglings) from September to May months. Few numbers were seen from June to August as non breeding seasons in the Nilgiri North Forest Division.

All four nesting colonies, the White-rumped vultures preferably construct their nests only on *Terminalia arjuna*

trees. This could be due to its height and basal girth which would help them to avoid disturbances from people and other wild animals especially elephants (Road, 2010). The present study area is falling part of the Nilgiris and Eastern Ghats Landscape which is considered to be the single largest Asian elephant population area in the word (Sukumar, 2003). On the other hand, the *Terminalia arjuna* is the only tallest tree species available abundantly along the riverine forests of Southern India. We observed that the single tree preference by White-rumped vultures for nesting and roosting in the study area. Our observation is also in accordance with Baral *et al.*, (2005), as a single tree preference (Kapok tree) by White-rumped vultures in Nepal.

The total white-rumped vulture population at four nesting colonies altogether ranging between 86 and 194 individuals in 59 constructed nests. Similar trend was noticed on the long billed vulture population also by ranging its numbers between 4 and 14 individuals. This present survey found that out of 59 nests 37 of them were incubated by white-rumped vultures. It was unfortunate to note that out of 37 incubations 21 fledglings were came out with 56.8% of breeding success. This was much better for long billed vultures. Out of 5 constructed nests 4 nests were incubated and 3 fledglings were came out with 75% breeding success. The previous studies in Rampur Valley showed that there were 72–102 individuals of White-rumped Vultures in six nesting colonies during their breeding season, with 50% breeding success at 70 occupied nests (Baral *et al.*, 2005). In Pakistan, a total of 2281 occupied nests were recorded between 2000 and 2004 and the nest success was observed in 1231 nests with the breeding success of 51% (Gilbert *et al.* 2006). In Africa, it was estimated that 48% of breeding success in White-backed vultures (*Gyps africanus*) (Martinez *et al.*, 1997). Among the earlier studies in Asia as well as Africa this present study has recorded highest percentage of breeding success which clearly envisages that this population is going in a positive trend towards their persistence as a wild and viable population in this region.

This present study we also observed that a total of 63.15% (n=36) of nests abandoned by White-rumped vultures during breeding season from October to December 2016. Newton (1979 & 2002) stated that certain pairs may occupy a territory for only a few days or a few weeks, or may even build a nest, but the process stops here. Not all raptor pairs occupying nesting territories lay eggs every year. A major influencing factor on egg laying in raptors was suggested that food supply and in poor food years, territorial pairs in some populations fail to lay eggs. On the other hand, nest abandon was seen due to mortality of chicks and nesting pair (Baral *et al.* 2005). Lopez *et al.* (2006) observed that severe anthropological threats in the nesting areas would also caused nest abandon criteria for Cinereous Vulture (*Aegypius monachus*) in the south west Iberian Peninsula. Apart from these reasons the langurs and monkeys also influenced some extent for abandon of nests by white-rumped vultures. The literatures supported that the langurs were causing disturbance in the nesting of vultures in Nepal (Subadi 2007) and also in African monkeys and baboons have been reported to interfere in the normal breeding of African vultures (Mundy *et al.* 1992; Emmett 2003; Roche 2000 & 2006). During this present survey we found the presence of Common langur (*Semnopithecus*) and Bonnet macaque (*Macaca radiata*) near to the nests of white- rumped vultures. Generally the Langurs and Monkeys behaves like playing, jumping and shaking the branches of nesting trees also. These activities might also caused deserted nesting trees (n=14) by white-rumped vultures. Therefore this present survey throw light on the need of long term studies to find various macro and micro level disturbances which might influence on the abandon of nests by white-rumped vultures for their long run conservation in this region.

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Poster Presentation

IS PEOPLES MOVEMENT AFFECT WHITE-RUMPED VULTURE NESTING COLONY: A CAUSE STUDIES FOR SIRIYUR NESTING COLONY, NILGIRI NORTH FOREST DIVISION, THE NILGIRIS, TAMIL NADU.

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Short note

Wildlife conservation today in areas of high human density is a very complicated undertaking (Woodroffe, Thirgood & Rabinowitz, 2005; Markovchick-Nicholls *et al.*, 2008). Habitat alteration, large infrastructures, poisons, biocides and illegal hunting are just some of the typical threats associated with urbanization. Habitat loss, electrocution on power poles and persecution by humans are the main threats to birds of prey in all around the world (Tucker & Heath, 1994). Persecution of raptors can take many forms, including destruction of nests, deliberate disturbance of nesting birds and poisoning, shooting and trapping adults and immature individuals (Sara & Di Vittorio, 2003; Whitfield *et al.*, 2004; Martınez *et al.*, 2006a).Disturbances affect some endangered species reducing the available breeding habitat (Sergio & Bogliani, 2000; Liberatori & Penteriani, 2001;Grande, 2006; Martınez, Pagan & Calvo, 2006b; Zuberogoitia *et al.*, 2006) and are a cause of breeding failure (Arroyo & Razin, 2006; Gonzalez *et al.*, 2006).

Vultures are highly associated with humans in nature the present study is highlighted the adverse effect on peoples activities in white-rumped vulture nesting in Siriyur nesting colony in Nilgiris North Forest Division, Nilgiris, Tamil Nadu. In the year of 2015 to 2016 the local people movement was intensively monitoring in Siriyur White-rumped vulture nesting colony which his closely associated with Siriyur Tribal settlement (250m). The observation quantifies the people's activities under the nesting colony such as bating, washing clothes, entertainment, livestock grazing, NTFP Collection, Bamboo cutting, Honey collection and Pilgrims threat. The threats was classified as minimum effect and maximum effect according to the threat impact as well as we priority the threats as low, medium and high. The results shows that bathing washing clothes, entertainment and livestock grazing are the regular activities observed under the nesting colony and these threats are classified as a minimum effects and low level threat priority. Bamboo cutting, Honey collection and Pilgrims threat are the short time threat but its highly disturbed the nesting colony due to the continuous disturbance to the particular time of the period these threats are classified as maximum effect and medium and high level threat priority for this kind of threats at the Siriyur nesting colony was abundant now and shift the nesting colony to the other places in this region. The causes of regression, breeding failure and distribution of hazards for species may show geographic variation, and causes absent in some areas may prevail in others. Because human recreational use of the natural environment is likely to increase in the future, the need to understand how wildlife responds to human activities is becoming increasingly important (Arroyo & Razin, 2006). Wildlife managers need appropriate tools to improve the protection of endangered species, demanding information about how, when or which types of human activity may be detrimental to wildlife in specific areas (Carney & Sydeman, 1999; Romin & Muck, 1999; Sitati, Walpole & Leader-Williams, 2005; Young *et al.*, 2005; Preisler, Ager & Wisdom, 2006). Some authors suggest that spatial and temporal restrictions are needed to protect the breeding and foraging sites of endangered species (Sara &Di Vittorio, 2003; Ontiveros *et al.*, 2004; Carrete & Donazar, 2005; Gonzalez *et al.*, 2006).

Table 1. Threat assessment on vulture in Sriyur nesting habitat

S.No.	Threat	Threat level	Threat priority
1	Bathing under the nesting tree	Minimum Effect	Low
2	Washing Clothes under the nesting tree	Minimum Effect	Low
3	Entertainment under the nesting tree	Minimum Effect	Low
4	Livestock Grazing in the Nesting habitat	Minimum Effect	Low
5	NTFP collection around the nesting habitat	Minimum Effect	Medium
6	Honey collection on the nesting trees	Minimum Effect	Medium
7	Pilgrims Threat around the nesting habitat	Maximum Effect	High

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IMPACT OF AWARENESS ON VULTURE CONSERVATION AMONGTHE SCHOOLS STUDENTS IN THE SIGUR PLATEAU, THE NILGIRIS

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ABSTRACT

The conservation of environment is embedded in the Indian culture and traditions. The art of living practiced nationwide imbibes respect and care for flora and fauna in the country. Attempts to generate awareness on environmental conservation in India were made by a few institutional mechanisms to provide a common platform for education in schools. Children are perceived to be the best messengers of waves of change. Lessons on values of moral education and natural resource conservation to children bring a fresh breeze of attitudinal and behavioural changes in society towards environment. The present study is aimed to create awareness on vulture conservation among the school students in Sigur Plateau, Tamil Nadu. A) To create awareness on the ecology and ethology of vultures and assess the awareness level of secondary school students on vulture conservation in relation to their community and residential background. B) To assess the class wise difference in the awareness level in vulture conservation among all the selected schools. C) To know the gender difference in the awareness level among all the selected schools.The present study is an attempt to examine the awareness level of secondary school students towards vulture conservation. Four schools were selected around Sigur Plateau for the study purposes. 1. Bokkapuram Government Tribal Residential School (BGTRS), 2. Mavanalla Government Tribal Residential School (MGTRS) and3. Vazhaithottam G.R.G Higher Secondary School, (VGRGHSS) and Masinagudi Good Sheppard High School, (MGSHS). A sample of 294 (141 boys and 153 girls) students from all three selected schools were participated in both the pre and post evaluation tests. The question paper contains vultures and their conservation relation questions, as broadly consists of five components, viz. (i) Vulture Morphology (ii) Vulture Biology (iii) Vulture Breeding Ecology (iv) Threats and (v) Vulture Conservation. There are 50 items in the question paper each carries the value of 1 mark, each wrong answer was given 0 marks. The pre-evaluation test result showed that middle school wise MGTRMC score better score compare than BGTRMS. Similarly in high school wise MGSHS score better score compare than VGRGHSS because of comprised of students from tribal and non- tribal community and also they are staying outskirts of the Sigur plateau and got lot of exposure to competitive tests. After the induction of vulture awareness classes to all the schools. The same results have been deploy during post- evaluation test MGTRMC score better score compare than BGTRMS. Similarly in high school wise on the contrary to the pre-evaluation test VGRGHSS score better score compare than MGSHS. Performance of improvement scale was estimated from the average marks scored in the pre-evaluation test subtracted from the average marks secured in the post evaluation test for each batch. The improvement scale was given as I (6-9 Marks), II (3-6 Marks) and III (1-3 Marks). Overall the improvement scale rating was higher in middle school wise MGTRMS similarly in high school wise VGRGHSS could be attributed to the impact of vulture conservation awareness classes coupled with improved confidence of students and their traditional knowledge induced them to perform better than the other schools. During the pre-evaluation test there was no significant average marks difference observed between all the classes of MGTRMS and MGSHS could be related to the same level of awareness on vulture conservation. There was a strong significant difference observed in middle school wise 6^{th} and 7^{th} and 8^{th} standard of MGTRMS could be related to the representation of non tribal community students and in MGSHS having exposure to competitive test and traditionally having sound academic background. During the post-evaluation test the class wise difference was observed between MGTRMS and VGRGHSS students could be related to the impact of awareness programme had improved their confidence level and induced them to perform better than other schools. There is no significant difference between male and female students. It is concluded that gender is not a factor affecting the awareness level; the main reason is that they are studying and learning together in the same teaching environment inside and outside the schools. However, The present study revealed that students residing inside the forest, especially tribal are academically very poor. After the vulture conservation awareness programme conducted they were little bit performed better than non- tribal students whose residences were in the periphery and outside the forests. Therefore more awareness campaign should be conducted to the students in the core as well as in the periphery to understand the ecology and behavior of vulture and to mitigate conflict and also the long term survival of the endangered species in the Sigur plateau region.

KEY WORDS: Impact of awareness, Vvulture conservation, Sschools students, Sigur plateau, Nilgiris

INTRODUCTION

The conservation of environment is embedded in the Indian culture and traditions. The art of living practiced nationwide imbibes respect and care for flora and fauna in the country. Attempts to generate awareness on environmental conservation in India were made by a few institutional mechanisms to provide a common platform for education in schools. Children are perceived to be the best messengers of waves of change. Lessons on values of moral education and natural resource conservation to children bring a fresh breeze of attitudinal and behavioural changes in society towards environment. Nature has created several ecosystems and millions of animal and plant species including micro-organisms within each ecosystem on mother earth and every life form has specific roles to play for auto-run of the ecosystem. All life forms are interdependent either to render services to one another or become food for the higher trophic level animals through a food chain or food web. If one species gets eliminated due to some reason or other, the food chain breaks consequently affecting the ecosystem automation process.

Man (*Homo sapiens*) is one of the species among millions of species created by nature and every animal or plant species has equal rights to live on earth as man has. We should also understand that they are not created to render services to the mankind alone, but to the nature as a whole. Man should not be a cause of extinction of other species, if not helpful for their existence. Wildlife is meant by all biotic elements on the Earth including all species of plants and animals excluding human beings, domestic animals and cultivated plants. Since time immemorial, our wildlife has been closely associated with our beliefs and folk lores. References on this can be drawn aplenty from our great epics and our rich history. Wildlife with their varied forms build up the balance of nature aside from making our lives more beautiful and meaningful on the planet. With a view to preserve the wildlife of India, particularly to take urgent steps to prevent extinction of any species, Government of India established the Indian Board of Wildlife (IBWL) in 1952, the highest body in the country established for laying down policy and issuing directives for proper management of Protected Areas. The Board has since been doing pioneering work to create public consciousness in favour of wildlife preservation. Therefore, in order to create a mass movement for protection of wildlife, the IBWL decided to observe the Wildlife Week from October 2 – 8 every year. During 2017 we are observing the 63^{ed} Wildlife week across the country. The World Bank estimates that forest provides habitats to about two-third of all species on the earth, and that deforestation of closed tropical rain forests could account for biodiversity loss of as many as 100 species a day. The destruction deplorably continues at an alarming rate due to encroachment, urbanization and industrialization resulting in reduction of forest density and extent. The depletion of wildlife can be attributed largely to deforestation and inroads of human civilization into the forest. Fragmentation of habitat and corridors isolate wild animals to small patches inviting inbreeding which starts of the process of extinction of the species from the earth. Wild animals are being poached ruthlessly to satisfy the greed of few rich persons for their luxury. International smuggling of wild animal trophies is next to narcotics smuggling and at par with arms smuggling. Millions of people representing a great variety of cultures and land-use practices live in or on the edges of tropical forests. Apart from the fact that they are somehow dependent on natural forest products, these people often do not have much in common. In recent years, however, a large number of them have experienced increasing difficulties in gaining access to local forests and their products owing to deforestation, logging, population pressure or increasing government regulations including declaration of state forests, national parks or wildlife reserves. In many countries, plans to protect forest ecosystems have failed to pay attention to the needs and knowledge of local people inhabiting them (Anan 1996, Tuxill and Nabhan 1998, Wily 1997, Kumar 2000). Thus participation of local people is essential for any conservation effort. With respect to forest conservation, participation is often associated with community forestry, which means that a forest is managed or co-managed by people who live close to the forest. Legal, political and cultural settings within which community forestry is practised vary considerably and accordingly, the term covers a range of different experiences and practices. Community forestry is often associated with South and Southeast Asia but it is also found in other regions (Wily 1997). While local participation is important in forest conservation, there are situations where it is absolutely necessary, i.e. under high population pressure and resource use conflicts, under communal ownership, and in smaller protected areas because of their vulnerability (Roche and Dourojeanni 1984). In such cases, conservation without local participation is doomed to fail. Nevertheless, participation itself provides no guarantee of success. This is because the outcome of participatory processes often depends on additional factors such as an institutional and legal framework or the education and interests of local people and other interest holders. As the case stories presented in this paper show, governments and their agencies play significant roles in participatory processes by providing - or by not providing – the 'enabling environment'. The present paper deals with different perspectives of participatory processes and, briefly, with key elements of enabling environments, i.e. appropriate institutional and regulatory frameworks, secure land tenure and various forms of capacity building. This presentation is based on the earlier paper by Isager and Theilade (2001) in which more detailed discussion on participation and forest conservation can be found. Our intention is to offer an overview of political and cultural contexts in which participatory processes inevitably take place. The present study is aimed to create awareness on vulture conservation among the school students in Sigur Plateau, Tamil Nadu.

STUDY AREA

Sigur Plateau is a plateau in the north and east of Nilgiri District in the Nilgiri Hills of Tamil Nadu, South India. It covers the 778.8 square kilometers. It comprises about 448.3 km^2 reserve forest of the Nilgiris North Forest Division, the 321 km^2 Mudumalai Tiger Reserve and about 16.2 km^2 of private lands. The average elevation of the Sigur plateau is 280 meters (919 ft). The boundaries of the Sigur plateau are Bandipur National Park to the northwest, Mudumalai

Tiger Reserve to the west, and Sathyamangalam Wildlife Sanctuary and Nilgiris East ranges to the east. The north side of the plateau is defined by the Moyar valley and the 260 metres (853 ft) deep Moyar Gorge. South of the Sigur Plateau is the higher Nilgiris Plateau. The Sigur Plateau is notable as an important wildlife corridor maintaining connectivity between the Western Ghats and the Eastern Ghats to sustain elephant and tiger numbers and their genetic diversity. It is an important link between several contiguous protected areas forming the Nilgiri Biosphere Reserve, the largest protected forest area in India. This area supports over 6,300 elephants, that represent the largest single population of elephant and tigers in India. The five major streams in the Sigur plateau are the Moyar River, the Sigur River, the Avarahalla River, the Kedarhalla River and the Gundattihalla River, which originate in the Nilgiris plateau. The Sigur Plateau is an important watershed area for the Cavery River and its ecological health is important to the many people dependent on the Cauvery

The Sigur Plateau is included in the list of important wildlife areas in the Nilgiri Biosphere Reserve (NBR). Sigur Plateau is connective junction of Western Ghats and Eastern Ghats. It's notable as an Important Bird Areas because it as a highest density of breeding critically endangered White-rumped vulture and small populations of another critically endangered Long billed vulture and Red headed vulture (Ramakrishnan *et al.*, 2010; 2012 and 2014 and Samson *et al.*, 2014; 2015; 2016 a.b.c). Although there are numerous numbers of tribal communities were residing in this plateau as well. There are two vulture nesting localities were recorded along the human settlements areas located near the river banks in the Sigur Plateau (Ramakrishnan *et al.*, 2014). Livestock cattle's populations were also high in these regions the tribal communities as well as non tribal communities were depending upon their livelihood for this livestock cattle's.

METHODOLOGY

The present study is an attempt to examine the awareness level of secondary school students towards vulture conservation. Four schools were selected around Sigur Plateau for the study purposes. 1. Bokkapuram Government Tribal Residential School (BGTRS), 2. Mavanalla Government Tribal Residential School (MGTRS) and 3. Vazhaithottam G.R.G Higher Secondary School, (VGRGHSS) and Masinagudi Good Sheppard High School, (MGSHS). A sample of 294 (141 boys and 153 girls) students from all three selected schools were participated in both the pre and post evaluation tests. The question paper contains vultures and their conservation relation questions, as broadly consists of five components, viz. (i) Vulture Morphology (ii) Vulture Biology (iii) Vulture Breeding Ecology (iv) Threats and (v) Vulture Conservation. There are 50 items in the question paper each carries the value of 1 mark, each wrong answer was given 0 marks. The researcher were personally visited the entire school during pre and post evaluation test and explained to the students how to respond the question in each section for the awareness test. Microsoft excel used for calculating mean and median marks scored by students during the test.

Pre-evaluation test

Pre evaluation test was conducted for the different school students to assess their knowledge about vulture and their conservation. The test comprised of multiple choices and true or false questions on various aspects of vulture. This test helped the students' knowledge about vulture before conducting the awareness programme.

Awareness programme for the students:

Awareness programme on vulture conservation using Power Point presentation had been done for all the school students. The main theme of the presentation was;

A. Vulture Morphology

Size, Shape and Morphological Characteristics

B. Vulture Biology

Digestive system, Defensive Mechanisms, Feeding, Bathing, Soaring, Carcasses finding

C. Vulture Breeding Ecology

Nesting Habitat selection, Mating, Nesting Behavior, Egg laying, Incubation, Chicks appearances, Parental Care

D. Threats

Human Disturbances, Livestock Grazing, Deliberate Poisoning and Diclofenac (NSAID) Threat

E. Conservation

Captive breeding Programme, Conservation Issues and Need for conservation action to ensure the healthy population of vultures in Sigur region

Post-evaluation test

After completion of the awareness programme, a Post-evaluation test was conducted all students in selected schools, separate question paper was framed for the post evaluation test. Post-evaluation test was carried out to examine the knowledge gained by the students. Marks scored by the students during the post-evaluation test were compared with pre-evaluation test.

Students improvement scale

Performance of improvement scale was estimated from the average marks scored in the pre-evaluation test subtracted from the average marks secured in the post evaluation test for each batch (Table. 5.3) The improvement scale rating was given as I (6-9 Marks), II (3-6 Marks) and III (1-3).

RESULT

The different schools and class students were participated in the pre and post-evaluation test. Among the middle schools wise, 8th standard students were participated higher 39%, followed by 7th standard 33% and 6th standard 28%. Followed by High schools wise, 6th standard students were participated higher 23%, followed by 9th standard 22%, 10th standard 20 %, 7th standard 19 % and 10th standard 16 %. In the present investigation, the level of awareness on vulture conservation has been identified on the basis of marks scored by the Middle school and high school students in all four selected schools. During the pre-evaluation test 294 students (52% of girls, 42% of boys) and post evaluation test 294 students (52% girls, 42% boys) were participated.

Average marks scored during the pre-evaluation test the middle school shows MGTRMS average score was 28.80 and BGTRMS 26.87. Followed by high school namely VGRGHSS average score was 29.49 and MGSHS 26.45. In the middle school level MGTRMS males and females were scored more marks in the pre-evaluation test the average score males was 40 and females average score was 27.63. On the other hand high school level MGSHS males and females were scored more marks in the pre-evaluation test the average score males was 29.65 and females average score was 29.30.

Middle schools wise MGTRMS score more marks in all component wise questions compare than BGTRMS the score wise maximum score was scored in vulture conservation (6.90) followed by vulture breeding (4.95), vulture biology (5.28), vulture morphology (5.76) and vulture threats (4.95). Similarly in the high schools wise MGSHS score more marks in all component wise questions compare than VGRGHSS the score wise maximum score was scored in vulture breeding (6.43) followed by vulture conservation (6.32), vulture morphology (5.70), vulture biology (5.56) and vulture threats (5.45)

Average marks scored during the post-evaluation test the middle schools shows MGTRMS average score was 38.66 and BGTRMS 35.03. Followed by high school namely MGSHS average score was 36.81 and VGRGHSS 34.46. In the middle school level MGTRMS males and females were scored more marks in the post-evaluation test the average score males was 42 and females average score was 38.51. On the other hand high school level MGSHS males were scored more marks in the post-evaluation test the average score males was 36.93 and VGRGHSS females were scored more marks in the post-evaluation test the average score was 37. 27.

Middle schools wise MGTRMS score more marks in all component wise questions compare than BGTRMS the average score wise maximum score was scored in vulture breeding (9.47) followed by vulture biology (8.04), vulture conservation (8), vulture morphology (6.70) and vulture threats (6.57). Similarly in the high schools wise MGSHS score more marks in all component wise questions compare than VGRGHSS the score wise maximum score was scored in vulture breeding (8.93) followed by vulture biology (7.69), vulture conservation (7.10), vulture threats (6.64) and vulture morphology (6.34).

Students improvement scale rating based on average marks obtained both pre and post evaluation test result shows that middle school wise MGTRMS improvement scale was all std student were scored first class (I) and BGTRMS improvement scale was 6th and 8th std students score First class and 7th std score second class. Similarly in the high schools wise VGRGHSS improvement scale was all std student were scored first class (I) and MGSHS 8th , 9th and 10th std were scored first class (I) and 6th and 7th std students score second class (II).

Pre and Post-evaluation test marks scored by both genders were taken for the analysis. The average mark scored during the pre- evaluation test was 27.75 and 26.82 for male and female students respectively and a Post-evaluation test average mark was 36.09 and 36.72 for male and female students and the improvement scale was both male and female score first class. Pre and Post-evaluation test marks scored by community wise were taken for the analysis. The average mark scored during the pre-evaluation test was 27.01 and 27.43 for tribal and non tribal students respectively and a Post-evaluation test average mark was 35.96 and 36.77 for non tribal and tribal students and the improvement scale was both tribal and non tribal students were scored first class.

DISCUSSION

In the present study, students from different community (tribal and non-tribal) and residential background were selected for conducting vultuure conservation awareness test. All selected schools were located in the vulture nesting habitat surroundings.

Percentage of student's participation

The finding of the present study revealed that students participated in both tests were equal number of representation from both gender, in a samples with female students slightly representing more than the male students could be related to the more number of female students representing in all the classes.

Pre and Post-evaluation tests

The pre-evaluation test result showed that middle school wise MGTRMC score better score compare than BGTRMS. Similarly in high school wise MGSHS score better score compare than VGRGHSS because of comprised of students from tribal and non- tribal community and also they are staying outskirts of the Sigur plateau and got lot of exposure to competitive tests. After the induction of vulture awareness classes to all the schools. The same results have been deploy during post- evaluation test MGTRMC score better score compare than BGTRMS. Similarly in high school wise on the contrary to the pre-evaluation test VGRGHSS score better score compare than MGSHS. This could be due to the impact of awareness programme (Hernandez *et al.,* 2001) which had improved their confidence level and induced them to perform better than other schools despite they are average in their studies.

Improvement scale

Performance of improvement scale was estimated from the average marks scored in the pre-evaluation test subtracted from the average marks secured in the post evaluation test for each batch. The improvement scale was given as I (6-9 Marks), II (3-6 Marks) and III (1-3 Marks). Overall the improvement scale rating was higher in middle school wise MGTRMS similarly in high school wise VGRGHSS could be attributed to the impact of vulture conservation awareness classes coupled with improved confidence of students and their traditional knowledge induced them to perform better than the other schools.

Class wise difference in vulture conservation awareness in pre and post evaluation test

During the pre-evaluation test there was no significant average marks difference observed between all the classes

of MGTRMS and MGSHS could be related to the same level of awareness on vulture conservation. There was a strong significant difference observed in middle school wise 6th and 7th and 8th standard of MGTRMS could be related to the representation of non tribal community students and in MGSHS having exposure to competitive test and traditionally having sound academic background. During the post-evaluation test the class wise difference was observed between MGTRMS and VGRGHSS students could be related to the impact of awareness programme had improved their confidence level and induced them to perform better than other schools.

Variation in vulture conservation awareness Gender wise

There is no significant difference between male and female students. It is concluded that gender is not a factor affecting the awareness level; the main reason is that they are studying and learning together in the same teaching environment inside and outside the schools. However, Daisy *et al.*, (2012) was observed significant difference between male and female students and perceived level of awareness after the environment education. The present study revealed that students residing inside the forest, especially tribal are academically very poor. After the vulture conservation awareness programme conducted they were little bit performed better than non- tribal students whose residences were in the periphery and outside the forests. Therefore more awareness campaign should be conducted to the students in the core as well as in the periphery to understand the ecology and behavior of vulture and to mitigate conflict and also the long term survival of the endangered species in the Sigur plateau region.

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CONSERVATION OF INDIAN LONG-BILLED VULTURE (GYPS INDICUS) AT PALARAPU CLIFF, TELANGANA, INDIA

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ABSTRACT

The Indian long-billed vulture (*Gyps indicus*) is a typical vulture, with bald head, very broad wings and short tail feathers. It is an avian natural scavenger, which is in the highest category of endangerment and listed in by IUCN and in Schedule I of the Indian Wildlife (Protection) Act 1972. The widespread usage of Diclofenac drug led to the rapid decline in population. Massive decline took place in 1996, greater than 97 % declined. Only about 30000 mature individuals are exiting in the wild of its range (India, Pakistan and Nepal). They are an important component of the ecosystem performing the role as scavengers by consuming dead and decaying animal carcasses, thereby keeping the environment clean and healthy. In Telangana a unique site of Indian long-billed vulture's breeding colony was identified at Palarapu cliff during 2013 near Nandigaon village in erstwhile Bejjur Forest Range. Telangana Forest Department has started vulture conservation project entitled "Conservation of Indian Long-billed Vulture (*Gyps indicus*) at Palarapu cliff" on 1st January, 2015. Monitoring of Birds, Diclofenac Survey, Publicity activities, providing feeding are the components in the Conservation Plan. The monitoring was carried out by direct observation using (12x-50mm) binoculars during the day time. The habitat is quite suitable for the Indian long-billed vulture. In this current paper, population trends of the Indian long-billed Vulture at Palarapu cliff in the past (3) years are discussed.

Key words: Indian long-billed vulture, Palarapu cliff, Population, *in-situ* Conservation

Introduction

Out of nine species of vultures, the population of three Gyps species; White-rumped Vulture (*Gyps bengalensis*), Slender-billed Vulture (*Gyps tenuirostris*) and Long-billed Vulture (*Gyps indicus*) in the wild has declined about 99% drastically over the past decade (Prakash *et al.*, 2012). The Gyps vulture declined in India 97% and 92% in Pakistan (Virani, 2006). Because of the evidence of widespread and rapid population decline, all three vulture species were listed by IUCN, the World Conservation Union, in 2013 as 'Critically Endangered' (BirdLife International, 2013). The Indian long-billed vulture (*Gyps indicus*) is a typical vulture, with bald head, very broad wings and short tail feathers. It is an avian natural scavenger, which is the highest category of endangerment and listed in Schedule I of the Indian Wildlife (Protection) Act 1972. The widespread usage of Diclofenac drug led to the rapid population decline. Massive decline in 1996, greater than 97 % declined. Only the total 30000 mature individuals are exiting in the wild of its range (India, Pakistan and Nepal). In Telangana a unique site of Indian long-billed vulture's breeding colony was identified at Palarapu cliff during 2013, then Telangana Forest Department has initiated project entitled "Conservation of Indian long-billed Vulture (*Gyps indicus*) at Palarapu cliff" on 1st January, 2015.

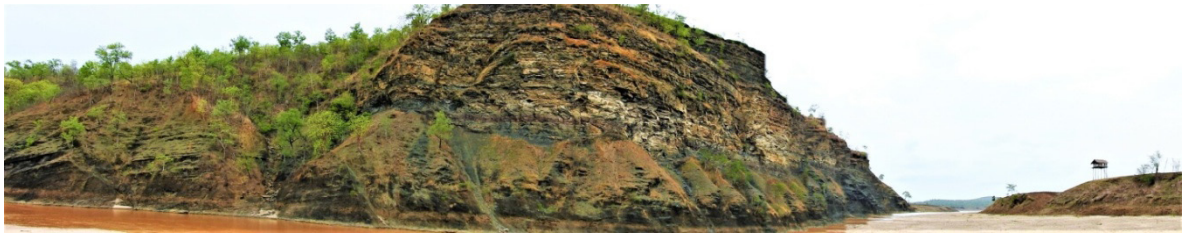
Importance of the species

The Vultures are social birds, feeding and roosting in colonies. They are an important component of the ecosystem performing the role as scavengers by consuming dead and decaying animal carcasses, thereby keeping the environment clean and healthy. Vultures are known to feed on rotting carcasses of ungulates, which may have died due to deadly diseases like Anthrax, Foot-and-mouth disease etc. A flock of vultures can consume a huge carcass within a half an hour and left over will be the bones, hooves and horns. They are long-lived birds with a life span of up to 50 years. They mature slowly too and start to breed only at the age of six or seven years. Genus *Gyps*, species breeds in loose colonies on trees or cliffs where twig nests are made. *Gyps* vultures lay only one egg in a clutch; the incubation period is 45 to 55 days and the young birds fledge when they are about three to four months old.

Methodology

Breeding colony of Indian long-billed vulture (*Gyps indicus*) is situated on the southern face of 80-90 meter high elevated rock cliff (108 meter total height of the cliff) , named "Palarapu cliff", in the Bejjur Reserved Forest nearby Nandigaon village at the confluence of Peddavaagu stream and Pranahita river. This habitat's geographical coordinates are 19°21'29''8 N latitude and 79°91'38''3 E longitude (**Fig.1**) of Nandigaon beat, Kammargaon section of Penchikalpet range of Kaghaznagar division, Telangana state. It is located near the border of Telangana and Maharashtra states. East side of this habitat has agriculture fields which extend up to Pranahita River, on South side Peddavagu, a perennial stream, is present and North and West parts are having forest area that are included in the Bejjur Reserved Forest. The vegetation is of Southern Tropical Dry Deciduous Forest type dominated by Indian Black wood (*Hardwikkia binata*).

A 'machan' is erected on the bank of the stream facing the habitat for continuous monitoring. Direct observation and also with (12x-50mm) binocular in the day time, the monitoring is carried out. Starting from the nest construction, the entire breeding season is watched.



Observations & Results

Our observation suggests that the habitat is quite suitable for the Indian long-billed vulture possibly due to following reasons: (**Fig.2**)

- Presence of ledges on the high elevated cliff suitable for nesting/roosting
- The habitat perfectly camouflage to the vultures. A trained eye can only locate the birds
- Availability of water, in adjoining perennial streams Peddavagu and Pranahita River
- Availability of nesting material (grass*, Themeda* sp.) around the habitat
- Presence of 40 white washed ledges (fecal droppings), which are indirect evidences of the birds' past usage
- More than 50 nests can be built in this habitat
- No hindrances while departing/ arriving in the nest. Plain bed of the stream useful for easy take off/landing
- Presence of trees of good height, viz., *Hardwickia binata* for roosting

At the beginning of "Conservation of Indian long-billed vulture (Gyps indicus) project" by Telangana Forest Department at this site, only 9 individual birds found. The population is stood at 26 individuals in 2015, 30 in 2016 and 32 in 2017.

Survey has been conducted in (20) villages that are falling in the vicinity of the habitat to know the administering Diclofenac drug to the cattle. It is observed from the survey that there is no usage of the said drug to cattle by the villagers. But, other observation is that cattle of old age and incapable of doing work and injured, are sold to slaughter house which result in less or no cattle mortality, which may in turn, result in scarcity of feed to the vultures.

Awareness is part of conservation of vulture; to know the importance of the vulture we conducted some awareness programs, classes. A brochure was designed in Telugu, with title "*Prakruthi Bandhuvu Raabandu*" which roughly translates as "The Vulture – well-wisher of the Nature", was distributed among officials, non-officials, students and people of Bejjur Range to create awareness regarding significance of Vultures and their role in eco-system and its conservation plan at Palarapu Cliff. Kalajatha Programs are being conduced in 66 villages across Kaghaznagar Forest Division. International Vulture Awareness Day on 2nd September, 2017 was celebrated at Kaghaznagar to create awareness among the students on vulture and its role in ecosystem.

***In-situ* CONSERVATION**

FEEDING CENTRE (Vulture Restaurant)

Supplementary feeding provided at feeding centre or vulture restaurants as major part of conservation, feeding provide to vultures were devised as general tool for the conservation of small scavenging birds population, being applicable to a number of species with differing feeding and life-history strategies (Mundy *el al.,* 1992; Piper, 2006; Gilbert *et al.,* 2007). Anticipating the scarcity of feed to the Vultures in the back drop of less or no cattle mortality in the surrounding villages, Vulture Restaurant (Feeding Centre) has been established by Forest Department in the vicinity of present habitat on the lines of Vulture Restaurants established in Gadchiroli District of Maharashtra and in Pathankot of Punjab. The selected site is on top of Palarapu cliff, which is the nesting site. No power lines are near, very far away (Piper, 2015). An area of one hectare is identified and chain linked fence has been erected to avoid the mammalian scavengers. The area is having trees suitable for perching and resting for vultures. For long term conservation and species recovery, this restaurant is useful to give Diclofenac-free carcasses to the vultures and help increase the population. So far 33 times, feed has been supplied since 2015, of these 7 times vultures fed themselves with a feeding success rate is 21.2 %.

Threats

The major threat of vultures is Diclofenac drug, after several researches, experiment result has shown that vultures killed by kidney failure in short period of feeding on carcass of an animal treated with normal dose 'Diclofenac Sodium' (Oaks, 2006). In India 'Neck dropping' was first recorded in Keoladeo National Park for several weeks before collapsing and falling out of trees at just prior to death (Prakash, 1999). This is an important indication where the birds under hot condition. In India and Nepal, and Pakistan similar of dead adults and sub adults of vultures with visceral gout and Diclofenac contamination, observed rate of mortality expected to be caused by Diclofenac (Green *et al.*, 2004).

VULTURE CONSERVATION IN INDIA

To increase population of Vultures in India, the Ministry of Environment and Forests, Government of India started implementation of Action Plan in 2006. To increase Vulture population, conservation and breeding centers are established in India by MoEF, Government of India at Pinjore (Haryana), Rajabhatkawa (Buxa Tiger Reserve, West Bengal), Rani (Assam) and also rescue and breeding centers were established in Nehru Zoological Park (Hyderabad), Bhubaneshwar (Orissa), Junagarh

(Gujarath) and Bhopal. And recently ten vulture restaurants are established in Kamlapur Range Sironcha Division of Gadchiroli Circle of Maharashtra State, where two species of Gyps such as Long-billed Vulture and White-rumpedd Vulture are recorded (Shukla & Lad, 2015). Banned usage of Veterinary Diclofenac drug in 2006, Government of India, advised to use Meloxicam drug (alternate pain killer), which leaves cattle carcasses safe for vultures and also Banned Multi-dose vials of Diclofenac drug for human formulations in September, 2015 by Ministry of Health, Government of India and only 3 ml. dose available. Vulture conservation Breeding Centre has established by Haryana Forest Department and Bombay Natural History Society (BNHS) at Pinjore, Asia's first 'Gyps Vulture Reintroduction Program' in June, 2016. It is an initial trial release of two Asian vultures (Himalayan Griffons) in India from the Jatayu Conservation Breeding Centre at Pinjore, Haryana. (*Source: www.jatayubreedingcentre.com*). In India's first vulture sanctuary established in Karnataka is Ramdevara betta Vulture Sanctuary, declared in 2012. (*Source: www.karnatakaforestdepartment.com*).

Conclusion

The southern Indian state of United-Andhra Pradesh has six species of vultures: White-rumped Vulture *Gyps bengalensis*, Long-billed Vulture *G. indicus*, Indian Griffon Vulture G. fulvus, Egyptian Vulture *Neophron percnopterus*, King Vulture *Sarcogyps calvus* and Cinereous Vulture *Aegypius monachus* (Ali & Ripley, 1983). An informal survey between 1990 and 1997 approximately 8,615 of Long-billed Vultures was recorded across 39 sites in 15 districts of the state (Srinivasulu & Srinivasulu 1999). And they sighted vultures at Mancherial, Kawal and Utnoor in Adilabad District, Telangana. A small colony (N = 7 nests) of Long-billed Vultures was recorded in Pocharam Wildlife Sanctuary, Medak District, Telangana until 1998. Since then on, nevertheless, no individuals were sighted in this area (C. Srinivasulu, in litt. 02 August 2014). Another survey conducted in 2007 by Umapathy *et al.,* (2009) that aimed to study the status and distribution of vultures, reported 13 Long-billed Vultures from Markapur in Srisailam Tiger Reserve, Mattadiguda in Utnoor and Dharmaraopet in Bellampally within Adilabad District, Telangana. Recently a paper has been published by Stotrabhashyam *et al.,* (2015) in the same study area; they well reported a total of 13 individuals among which, they recorded, in month of February and March, 2014. But our study clearly shows that the population of Long -billed Vulture is now increasing in the present study area, from mere (9) individuals to 26 individuals in 2015 (Ravikanth & Ram Mohan, 2016), 30 individuals in 2016 and 32 individuals in 2017. In order to protect and conserve the present area, a draft proposal for declaring as Vulture Sanctuary has been mooted by the Telangana State Wildlife Board and the proposals is being prepared.

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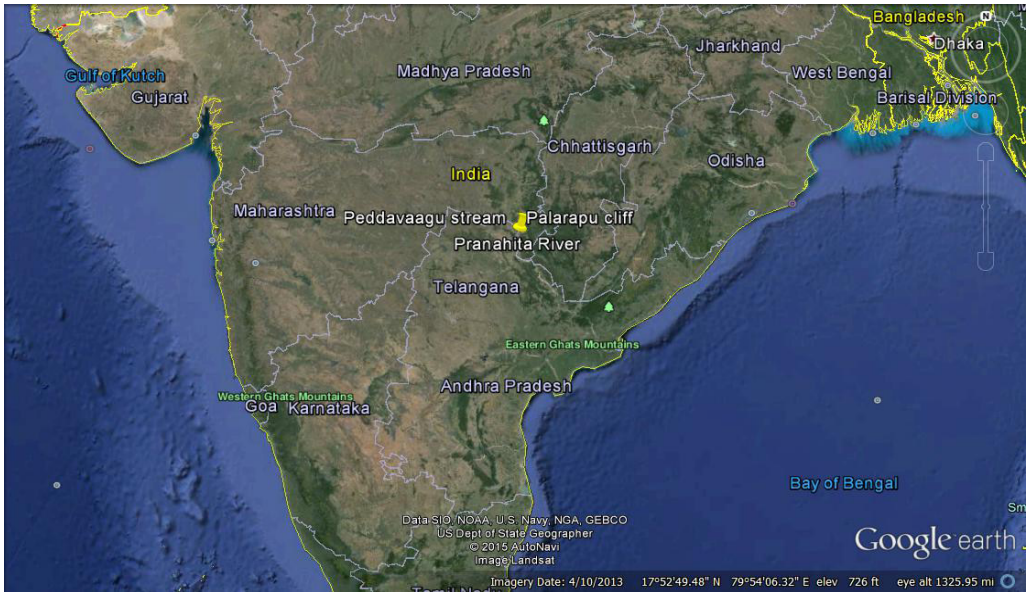

Figure 1: Google Earth map showing the location of breeding colony of Indian long-billed vulture, Palarapu cliff

Figure 2: A view of breeding colony of Indian long-billed vulture, Palarapu cliff

Indian long-billed vultures in the nests at Palarapu cliff

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POPULATION STATUS OF THE ENDANGERED VULTURE (GYPS BENGALENSIS), NILGIRI DISTRICT, TAMILNADU, INDIA

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ABSTRACT

The Oriental White backed vulture (*Gyps bengalensis*) once seen widely, but it has now shown decline in its population in many areas. This study was undertaken to collect information about population density of *Gyps bengalensis* in different localities like Masinagudi and Theppakadu. The study aimed at finding reasons and consequences of changing population pattern of vulture. The study was conducted over a period of ten months (November 2011 – August 2012). Regular field trips were made at intervals of one or two weeks. It was seen that the vultures inhabit in dense forest like evergreen, moist deciduous and teak forest areas. There is a definite decline in their number over the past decade. This is because of deforestation, forest fire, loss of nesting sites, food sources, increase in predators and pollution.

Key Words : Gyps bengalensis, Population status, Nilgiris, Diclofenac, Endangered.

Introduction

India is characterized with unique richness and diversity of its vegetation and wildlife. India's dense forest reserves are the perfect abode for its equally dense wildlife which includes about 350 mammal species, more than 1200 species of birds in nearly 2100 forms and more than 30,000 species of insects. Besides this, there is rich wealth of marine life having number of species of fish, amphibian and reptiles. More than 75 National parks, 425 Sanctuaries cover over 4.5% of India's geographical area. Indian wild life has got important place in its rich heritage and culture. Many animals and plants are worshipped and are regarded as the companions in India. The country also has about 2000 species and sub-species of birds. The numerous sanctuaries across the country are not only breeding colonies for these feathered creatures, but serve as resorts for migratory birds from higher altitudes, as well. Indian wildlife has its share of native birds along with the migratory birds. Several hundred species of birds can be spotted across India. Many natural populations have been reduced in size due to increased human activities associated with landscape changes and persecution (Mace *et al.,* 2005). Concern exists because significant reductions in the size of large populations will likely cause a loss of genetic diversity due to drift and increase extinction risk by adversely affecting the ability of populations to adapt to changing environments (Willim *et al.,* 2006). Vulture is the name of a bird that mainly preys on dead animals and occasionally hunts its own quarry. It is found across the world, with the exception of Antarctica and Oceania. The vultures are all obligate scavengers, feeding primarily on the carcasses of large ungulates and nesting and roosting, often colonially, on cliffs or in trees. The Indian White-rumped vulture (*Gyps bengalensis*) is an Old World vulture in the family Accipitridae. It is closely related to the Gyps fulvus. So it was called as Oriental White-Backed Vulture. In the early 20th century, the Indian White-Backed Vulture (Gyps bengalensis) was abundant, and its distribution extended from the Thai-Malay peninsula and Indo-china in the east to the Indus River, running through Pakistan, in the west (Oak *et al.,* 2004). However, a recent survey in India indicated a catastrophic collapse in the population of G. bengalensis, which had been totally wiped out from 17 key areas in that country (Rae, 1935). G. bengalensis was regarded as "possibly the most abundant large bird of prey in the world" (Houston, 1985). White Rumped Vultures are typical vulture, with an unfeathered head and neck, very broad wings, short tail feathers, medium-sized and dark vultures. It has a white neck ruff. The adult's whitish back, rump and the under wing coverts contrast with the otherwise dark plumage. The body is black and the secondries are silvery grey. The head is tinged in pink and bill is silvery with dark Ceres. The nostril openings are slit-like. Juveniles are largely dark and take about four or five years to acquire the adult plumage. In flight, the adults show a dark leading edge of the wing and have a white-lining on the underside. The under tail coverts are black (Rasmussen and Anderton, 2005). Adults are 75 to 85 cm tall, their wing span is 180 to 210 cm, and their weight ranges from 3.5 to 7.5 kg. The sexes are approximately equal in size. Adults are darker than juveniles, with blackish plumage, a white neck-ruff, and a white patch of feathers on the lower back and upper tail. During flight, the white under wing coverts are highly visible. Usually the eyes are a yellowish brown colour and the legs are blackish. The bill is short, deep, and stout. Immature G. bengalensis are dark brown and the lower back and rump area are brown rather than white. The under wing coverts are dark brown. Eyes are dark brown and the legs are blackish but lighter than the adult. Generally, adults tend towards black colouration, while younger individuals are browner. All G. bengalensis can be distinguished by the white bar located on the underside of the wing. (BirdLife International, 2004 & Rasmussen and Anderton, 2005). According to the Red Data Book, Oriental White Backed Vulture has suffered an extremely rapid population decline, particularly across the Indian subcontinent, probably as a result of disease compounded by poisoning, pesticide use and changes in the processing of dead livestock (Threatened Birds of Asia, 2001).

Materials and Methods

The present study was taken to reveal the population capacity and addition of the Meloxicam drug an alternative for the Diclofenac toxicity of endangered vulture, Gyps bengalensis (Plate-1). The study was made in Nilgiri district, Tamilnadu, India.

Study area

Mudumalai sanctuary

The Mudumalai Sanctuary is as an important wildlife habitat, because of its strategic position. As a Wildlife corridor between several other protected areas that are a part of the Nilgiri Biosphere Reserve. At north to this the Bandipur National Park and Nagarhole National Park is there and in the west the Wayanad Wildlife Sanctuary and in the south Mukurthi National Park and Silent Valley National Park are there. At the east the Segur plateau which connects to the Sathyamangalam wildlife sanctuary and Reserve forests is located. There is a high diversity of animal life in the sanctuary with about 50 species of fishes, 21 species of amphibians, 34 species of reptiles, 227 species of birds and 55 species of mammal. Mammal diversity is higher in the dry deciduous and dry thorn forests than in the other habitats. Thirteen percent of all mammal species in India are present in Mudumalai wildlife Sanctuary. Eight percent of bird species in India occurring in Mudumalai Wildlife Sanctuary. Among the 227 bird species found in Mudumalai, 110 species are insectivores, 62 are carnivores, 23 species are fishivores, 12 species are omnivores and 20 species are grainivores.

Thengumarahada

Thengumarahada occupy the area of 28 sq.km and 9.4km away from Kotagiri taluk.

Climatic conditions

In Mudumalai sanctuary the winter season takes place from November to February. Normally it has the temperature from 18º C -20º C and average rainfall 1020mm. The hot summer season falls at March to May and the temperature ranges from 26º C -33º C, average rainfall 790mm and the rainy monsoon season usually arrives at June to September. This season has heavy rainfall 1840mm and the temperature ranges from 20ºC -24ºC. In Thengumarahada the winter season are from November to February. It has the temperature 20º C -22º C and average rainfall 870 mm. The hot summer season are from March to May and the temperature ranges from 28º C -32º C, average rainfall 640 mm and the rainy monsoon season usually from June to September. In this season has heavy rainfall 1450 mm and the temperature ranges from 20º C -24º C.

Catchment areas

The studies were done at two locations in Nilgiris district. They are Mudumalai sanctuary (Masinagudi, Thepakadu, Mudumalai) and Thengumarahada. The sanctuary has an area of 321Sq. Km with 108 Sq.km of National park area. The altitude ranges from 100' MSL to 1200' MSL. Thengumarahada occupy the area of 28 sq.km and 9.4km away from Kotagiri taluk.

Road transect method (Fuller and Mosher, 1987)

Road transect method is very useful for counting vulture ranging in wider areas. This method was employed to determine vulture species distribution in Mudumalai sanctuary and Thengumarahada. Roads and trails in the park provided convenient access to the study area were used as transects for survey carried out monthly in clear weather by a two member team about an hour after sunrise on a moving vehicle (with speed 20 km/hr) stopped at specified points to survey the vulture. This allowed large areas of the park to be searched efficiently for vulture. A pair of good binoculars and digital camera was used to aid identification of distant birds.

Encounter transects (Abdul Jamil Urfi, 2004)

Using prepared base map identifies (preferably randomly) the starting point of the transect, before starting our survey record the required transect information and weather conditions at the top of the data form: Bird Observation Form – Vulture.This method was employed to determine vulture species distribution in Mudumalai sanctuary and Thengumarahada. 0.5-2 Km are recorded as one transect, like that 23 transects were recorded in the survey area. Among these 19 transects in Mudumalai and 4 transects in Thengumarahada were studied. For each vulture detection, record the distance traversed along the transect. Vultures encountered along the transect must be recorded. Each transect should be surveyed in morning to evening.

Visual Scanning Method (Jathar and Rahmani, 2003)

The field survey for the vulture was carried out by the visual scanning method. Visual scanning involves purposeful scanning of treetops for locating the vultures. For this purpose, a binocular was used. Field trials for this method were taken to assess best times of the day for visual scanning. Early to mid-mornings and evenings were found to be the best times.

Data Collection Parameters

Macro and Microhabitat Assessment

From previous studies and literature, it was known that the vulture prefers dense forests and teak-bearing miscellaneous forests and can also be found in areas close to human habitation. We recorded a number of survey parameters at each survey point to determine the habitat preference of the species. We also carried out an assessment of threat due to human presence in the area. These are described below.

Field Survey Protocol

Composition of the Survey Team

The survey teams consisted of a field biologist and a field assistant and were generally accompanied by a guide, either a local villager or a staff member of the Forest Department. Presence of a staff member during the survey was useful in obtaining information about the area, location and compartment numbers of the site.

Selection of Survey Locations

Forest divisions having good quality vegetation cover were selected from the vegetation density maps of each state prepared by Forest Survey of India (Forest Survey of India, 2005). Forest Divisions having fragmented and low density forests were not included in the survey. Based on the premise that the vulture was found in ever green forestswe selected forest circles and forest divisions having evergreen

forests and moist deciduous forests, for the survey. These divisions were selected based on discussions with knowledgeable forest officers of the state.

Survey Itinerary

The route for the survey was planned prior to starting the survey. From the vegetation map of the state, districts having open dry deciduous teak forests were selected and marked on the map. Survey itinerary was finalized after assessing the area to be covered and the available time.

Discussion with Local Officers and Staff

Before beginning the survey in a forest division the survey team generally met the Deputy Conservator of Forests of the forest division and obtained information regarding the best ranges to survey. Ranges having fragmented and degraded forests were omitted. Ranges having open dry deciduous teak forests were selected for the survey. With the help of the range forest officer and field staff of the range we identified convenient roads and trails passing through the forests of that range for carrying out the survey. The survey was carried out in the forests along these roads and trails.

Season

Seasonal effects can be more difficult to cope with. Bird conspicuousness will probably change with season, and in tropical forests there may not be synchronization of breeding cycles between or even within species. In a species which is breeding, the males may be singing and calling to defend a territory and so may be easy to record, whereas the females incubating eggs may be the opposite. There can be no hard and fast rules about whether studies are better designed to avoid or coincide with the peaks of breeding activity, as this is better determined by the aims of the study.

Weather conditions

Adverse weather conditions such as low cloud, high winds, rainfall and even very high temperatures can affect census results in three ways. Firstly, bird activity can be directly affected (usually reduced), which will affect the efficiency and reliability of our data collection. Secondly, the conditions could reduce our chances of actually seeing or hearing the birds. Thirdly, we cannot pay adequate attention to counting if the conditions are too hot, too cold or wet. Census results can also be affected by conditions underfoot (during dry periods, fallen leaves may become very noisy to walk on), or by the noise of cicadas (whose activity is influenced, amongst other things, by temperature and humidity).

RESULTS

The survey areas are Masinagudi, Theppakadu, Mudumalai and Thengumarahada. The survey took place in the three different seasons, from October to September. Survey of vultures done in winter, hot summer and rainy monsoon seasons. In Mudumalai sanctuary winter season, temperature is very low at 18ºC to 20 ºC, hot summer season, temperature is very high at 33 ºC and in rainy monsoon season the temperature come to down at 22 ºC to 24 ºC. At end of the winter season only (Nearly February) the vultures can be seen frequently. In hot summer seasons the vultures were seen rarely because of high temperature, scarcity of food, water and mainly forest fire. In rainy monsoon season there will be heavy rainfall, it affects our survey and also birds were migrated to another place. In Thengumarahada winter season, temperature is very low at 20ºC to 22 ºC, hot summer season, temperature is very high at 28ºC to 32ºC and in rainy monsoon season the temperature come to down at 20 ºC to 24 ºC (Table 1).In Mudumalai sanctuary, highest rainfall 1840 mm in rainy monsoon season. In winter season 1020 mm rainfall and in summer season 790 mm rainfall was noticed. In Thengumarahada highest rainfall 1450 mm recorded in rainy monsoon season. In winter 870mm and hot summer 640 mm rainfall was registered (Table 2). In our survey most vultures are recorded in Mudumalai than other three regions. Only one vulture was observed in Thengumarahada. The survey has done by two different methods namely Road transect method and Encounter method. Road transect method done by moving vehicle. In road transect method, each transects are separated based on the kilometers. The study area was divided into nine transects. Each transects contain 10 Sq. Km. In road transect method, only three individual vulture were found in Theppakadu, Mudumalai and Thengumarahada. In this project there is no possibility to see the vultures in Masinagudi area in road transect method. Vultures seemed by road transect method in Theppakadu at 30-40 km ranges, in Mudumalai at 70-80 km ranges and in Thengumarahada at 10-20 km ranges (Table 3). Encounter transect method was done in same study area for counting the vulture population this method was very convenient. In encounter method each and every Sq. km surveyed. So this method is very accurate. Each transect was occupied every Sq. Km. of the areas. In Masinagudi, three vultures are observed in February and June. In Theppakadu and Thengumarahada three vultures was recorded in February and March in dense forest areas. The rich flora and fauna were found in Mudumalai area. The availability of food is more in this area. In this area only high numbers of vultures are recorded in January, February and July. In both of the transect methods, more number of vultures were recorded by Encounter transect method. In total, we covered 132 Sq. Km. across 89 Sq. Km. for road transect method and 43 Sq. Km. for encounter transect method. There, we saw 11 individuals of white- backed vultures in various habitats. Our study areas are rich in vegetation. So vultures are breed in those areas. In that nine white-backed vultures are found exclusively in the evergreen and moist deciduous forest. Other two individuals sited in teak forest. Evergreen forest contains high number of large trees. It is a good habitat for vultures, because vultures want to live in highest places.

DISCUSSION

In South Asia, the populations of the endemic Oriental White Backed (*Gyps bengalensis*), Slender Billed (*Gyps tenuirostris*) and Long Billed (*Gyps indicus*) vultures have declined dramatically by more than 95% since the early 1990s, and the evidence suggests that the few that are left continue to decline at between 15% and 50% per year.

These three species which, together, just 15 years ago, used to number tens of millions (possibly 40 million of one species in India alone), are now almost unbelievably at serious risk of global extinction and are listed as 'Critically Endangered' by the International Union for Conservation of Nature (IUCN, 2005). The decline of vultures is worrying from a biodiversity viewpoint, but also because a great number of carcasses are being left uneaten" Cunningham (2000) says, "Vultures play an important role in scavenging human and animal carcasses". For example, In India's 76000 strong Parsees community peoples bones do not buried but their bones are cleaned by vultures alone. In India, Gyps vulture's numbers diminished by several reasons. Extreme examples are G. bengalensis, which often lives in close association with humans. Humans may be a threat to G. bengalensis because of the usage of vultures as a source of medicines (Aminur Rahman, 2009), diseases, pesticides (DDT and HCH), environmental contamination, poisoning, habitat alterations, reduced food availability (Thiollay, 1998), calcium deficiency, reduced nesting habitat, nest predators, hunting (Pain et al., 2008), Climate change (Mc carty, 2001) and aircraft strikes (Bhatnagar, 1993).

Diclofenac is a widely available veterinary drug in the Indian subcontinent, where it is used for the symptomatic treatment and management of inflammation, fever, and/or pain associated with disease or injury in domestic livestock. Scientific evidence following the observation of waste disposal practices of carcasses confirms without doubt that the veterinary use of Diclofenac is the main cause of these declines (Green et al., 2004) throughout the Indian subcontinent. The realization that Diclofenac, a Non Steroidal Anti-Inflammatory Drug potentially nephrotoxic to birds, had become a widely used veterinary medicine led to the identification of Diclofenac poisoning as the cause of the decline. Surveys of Diclofenac contamination of domestic ungulate carcasses, combined with vulture population modelling, show that the level of contamination is sufficient for it to be the sole cause of the decline. Post-mortem examinations of vulture carcasses revealed visceral gout (deposition of uric acid crystals in the tissues) as the cause of mortality in most of the dead birds. As a consequence of the collapse of South Asian vulture populations, national and international conservation organizations have concluded that it is essential to ban the use of Diclofenac in domestic livestock so as to remove it as a toxic contaminant of the food of wild, scavenging vultures. At a meeting of the National Wildlife Board in March 2005, the Government of India announced that it intended to phase out the veterinary use of Diclofenac within six months. In 2006, the Governments of India banned the manufacture of Diclofenac. This sends a very clear signal and is welcome. However, retail sale of Diclofenac not manufactured for veterinary use remains legal in these countries, so full bans on retail sale for veterinary use may be necessary (Nita Shah, 2008).

CONCLUSION

The Governments of the respective countries may take immediate steps to completely phase out veterinary Diclofenac. This would have to be complemented by aggressive awareness campaigns about the adverse ecological effects of the drug. To conduct a reliable population estimate at State, country and regional levels. Efforts should also be made to raise strengthen education and awareness campaigns among veterinarians, pharmacists, livestock owners and general public, of the problem of Diclofenac contamination and availability of safe alternative Meloxicam. Captive holding and breeding of vultures until Diclofenac is controlled is recommended as a precaution to ensure the long term survival of the threatened species and to provide a stock of birds for vultures reintroduction programme. In situ and Ex situ conservation project, vultures should be fed on carcasses of animals that are known not to have been treated with Diclofenac in the week before death. Vulture restaurant will be a great solution for increasing the population of Gyps bengalensis to be with poisonless feeds. It will help the vultures from poison death and will increase in its genes. Setting up of a Task Force for the region to collaborate in vulture conservation programmes in these regions.

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Table 1: Temperature and seasons of the study areas

Survey area	Month	Season	Temperature (ºC)
Mudumalai sanctuary a) Masinagudi b) Thepakadu c) Mudumalai	October-February	Winter	18 ºC- 20 ºC
	March-May	Hot summer	26 ºC- 33 ºC
	June-August	Rainy monsoon	20 ºC- 24 ºC
Thengumarahada	October-February	Winter	20 ºC-22 ºC
	March-May	Hot summer	28 ºC-32 ºC
	June-August	Rainy monsoon	20 ºC-24 ºC

Table 2: Rainfall and seasons of the study areas

Survey area	Month	Season	Rain Fall
Mudumalai sanctuary a) Masinagudi b) Thepakadu c) Mudumalai	October-February	Winter	1020
	March-May	Hot summer	790
	June-August	Rainy monsoon	1840
Thengumarahada	October-February	Winter	870
	March-May	Hot summer	640
	June-August	Rainy monsoon	1450

Table 3: Vultures observed in study areas by Road transect method

Survey area	No. of Vultures observed in road transect (Sq. km)								
	1-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90
Mudumalai sanctuary a) Masinagudi	-	-	-	-	-	-	-	-	-
b) Theppakadu	-	-	-	-	-	-	-	-	-
c) Mudumalai	-	-	-	**	-	-	-	**	-
Thengumarahada	-	**	-	-	-	-	-	-	-

IMPACT OF MELOXICAM DRUG AN ALTERNATIVE FOR THE DICLOFENAC TOXICITY ON THE WHITE BACKED VULTURE (GYPS BENGALENSIS), NILGIRI DISTRICT, TAMILNADU, INDIA

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ABSTRACT

The Oriental White backed vulture (*Gyps bengalensis*) once seen widely, but it has now shown decline in its population in many areas. This study was undertaken to collect information about population density of *Gyps bengalensis* in different localities like Masinagudi and Theppakadu. The study aims at finding reasons and consequences of changing population pattern of vulture. The study was conducted over a period of ten months (November 2011 – August 2012). The majority of dead vultures had visceral gout, due to kidney damage. The realization that diclofenac, a Non-Steroidal Anti-Inflammatory Drug potentially nephrotoxic to vultures, had become a widely used veterinary medicine led to the identification of diclofenac poisoning as the cause of the decline. We conclude that the continual maintenance of multiple widely dispersed provisionally sites it will only ever be possible to reduce diclofenac contamination. Elimination of diclofenac in veterinary use is the most certain way to prevent vulture deaths from diclofenac exposure, although education of verterinarians and livestock owners to avoid treatment of terminally ill livestock, or to bury or burn carcasses of recently treated livestock, may also be helpful.

STATE OF VULTURE POPULATION AND ITS NEED FOR AWARENESS AMONG PUBLIC ABOUT THE ROLE OF VULTURES IN THE ECOSYSTEM

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ABSTRACT

Nine species of vultures are distributed in India and most of them are decreasing in recent decades. As recently as 1980s, there were about 80 million white-rumped vultures (*Gyps bengalensis*) in India; but today its population numbers only in thousands. In the past 15 years, the country's vulture population has declined by a whopping 99%. There are currently about 100,000 vultures left in India, compared with 40 million of them in the 1980s. When the birds eat carcasses of cattle treated with the drugs resulted kidney failure and die. India's introduction of diclofenac in the 1990s proved immediately calamitous to the country's vultures and the Indian white-rumped vulture declined by 99.9 percent. Many experimental studies showed that the amount of diclofenac a vulture might ingest from a carcass could kill it few days. Diclofenac is a veterinary drug now banned in India but still being illegally used as an anti-inflammatory agent for cattle. Unlike DDT, which devastated populations of birds of prey, diclofenac does not accumulate in the tissues of livestock or birds, but turns out as poison for the vultures. *Gyps* species were the most affected by diclofenac and between 1993 and 2002, its population fell 99.7%. The populations of the Indian vulture (*Gyps indicus*) and the Slender-billed vulture (*G. tenuirostris*) fell by 97.4%. Similarly, Egyptian vultures

(*Neophron percnopterus*), an endangered species whose global population (of 30,000–40,000 mature individuals) is declining (IUCN 2010) due to loss of wild ungulates, overgrazing by livestock and poisoning. The species in India was driven to rapid decline by Diclofenac. There are no outward indicators of age on raptors. Typically, Turkey Vultures will live an average of 10 years in the wild. The oldest recorded wild Turkey Vulture was 16 years, though this seems to be rare. People are usually known about vulture eating habits, but what they do not realize is the role of vultures in the ecosystem as carrion disposer that would otherwise be a breeding ground for disease. Therefore, awareness about role of vulture in ecosystem needs to be conducted for the local people, so as to avoid use of such drug that devastates the vulture population in India.