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EVALUATING THE IMPACT OF HUMAN DEVELOPMENT ACTIVITIES WITHIN AND OUTSIDE WILDLIFE PROTECTED AREAS ON THE BEHAVIOUR OF ELEPHANTS IN AFRICA – A REVIEW OF JOURNAL ARTICLES

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ABSTRACT

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Key Words: Elephant Behaviour, Development activities, Evaluation, Impact, Protect wildlife area

Introduction

This document is a review of five journal articles in the broad area of project management. The document has explored the different reactions of wildlife especially elephants when subjected to different stimuli with an aim of understanding the behavior of the animals for better management within the protected and outside protected areas. The review has explored the weakness of each article and made recommendations aimed at strengthening future work of similar nature.

Article 1: Roadless Wilderness Area Determines Forest Elephant Movements in the Congo Basin. PLoS ONE 3(10): e3546. doi:10.1371/journal.pone.0003546[1]

This article is authored by nine experts from eight different institutions in the United States of America, Germany, France, United Kingdom and Kenya. Stephen Blake and Sharon L Deem are professors from the University of Missouri St. Louis USA while Professor Ian Dauglas-Hamilton is a Scottish expert in elephant behavior working with Save the Elephants. Fiona Maisels is an expert in wildlife conservation while Professor Inogwabini-BilaIsia is from the University of Kent, Canterbury United Kingdom (UK).

In literature review, the authors have established that roadless wilderness is significant for conservation of terrestrial ecosystems. However, they note that this is counter to the goals of developers and economists who value roads in the wilderness for purposes of resource exploitation for economic development.

Blake et al (2008)argue the Congo Basin is of significant importance as it is the second largest rainforest block on earth with outstanding biological diversity including the great apes and forest elephants (Loxodonta Africana Cyclotis). There are international efforts aimed at conserving the Congo forest managed through the Congo Basin Forest Partnership (CBFP) focusing on the holistic management of the ecosystem. The article acknowledges the significance of landscape management of natural resources with a view to conserving key biodiversity requiring large wilderness areas since protected areas are themselves too small to ensure survival of large-bodied, wide ranging species such as top carnivores, and savanna elephants which routinely stray outside parks into unprotected areas. The authors have noted that elephant killings mainly happen next to road networks in Congo. This has forced elephants to respond through two broad behavioral strategies namely the siege or skirmish. The siege refers to the behavior of elephants concentrating on small zones (relative to the protected area) farthest from the roads for safety or Skirmish which entails the elephant traverses the rangelands in disregard of the dangers. It is noted that both strategies are risky to the survival of the elephants as siege leads to overpopulation hence competition for resources while skirmish results in mortality from illegal killings.

Materials and Methods

Forest elephants were fitted with Global Positioning System (GPS) collars under the supervision of the field veterinary officer. Data was provided by the Global Forest Watch (GFW) supplemented by local knowledge for roads that were recently built the researchers calculated the Roadless wilderness areas. General Additive Models (GAM) was used to investigate the relationship between home range metrics and roadless wilderness area and assess the influence of several other covariates, including number of day's collard, site, sex and landscape. In order to assess differences in movement of forest elephants, the researchers classified roads into protected and unprotected. Protected roads were those inside protected forest areas while unprotected were outside the protected forest areas. The swathes of cleared vegetation as a result of roads ranged

from 4 meters to 15 meters and all roads were lateritic. Traffic was generally low with a maximum of 20 logging trucks per day on the busiest roads.

In my view, the methods used was good but it could be strengthened or improved by ensuring that elephants of different gender and age were specifically enlisted and observed. This is because lone male elephants have a different behaviour from elephants in a herd. Also, young elephants not exposed to different experiences would most likely behave differently when faced by similar situation to those that have had prior experiences. This would therefore enable a comparison by the researchers leading to a more balanced conclusion.

Results

A total of 28 forest elephants were fitted with GPS telemetry collars in 6 Roadless wilderness areas in priority conservation areas of different sizes ranging from 49KM^2 to 11,793 KM^2. 4 elephants did not have an option of crossing protected road since they were not there in Minkebe National Park. However 17 out of the balance of 24 crossed protected roads. By contrast only 1 female elephant with dependents crossed an unprotected road once over a period of 28.5 years of telemetry data from 27 elephants. One elephant named Muadje crossed an unprotected road 3 times. However the crossing points on all occasions were at points furthest from any village in her potential range. Further, it was noted that the average daily distance of travel on normal movements was 1.7 KM but this increased 14 fold to a mean of 24.1 Km when crossing the road. Two other collard elephants also crossed protected roads abut 11times over the same period. It was noted that their mean speed on crossing the roads was 1.9 and 3.5 KM respectively compared to normal time speeds of 1 and 2.5 KM. This shows that speed increased while crossing roads. The authors have also noted that the elephants adopt a siege strategy which reduces risk as opposed to the skirmish strategy.

Weaknesses of the paper

The authors have indicated that the elephants adopt siege strategy as opposed to the skirmish strategy in the forests. However, they have not given or shown data to support this kind of assertion. It can therefore best be termed a guess.

Additionally, the study has failed to segregate animals under study into age groups and those in a herd and lone elephants. It is known that male lone elephants have aggressive behaviour compared to elephants in a herd. Further, young elephants may not have had the benefit of prior experiences which may make them react differently to situations as opposed to older elephants with repositories of memories. The study would therefore have achieved better results had the methodology been refined more to include the parameters of age, sex and those elephants in a herd and the lone male elephants.

Strengths of the paper

The Paper has indicated the methodology used to arrive at most of its conclusions which is a very positive move. The speed of the elephant crossings in both protected and unprotected roads has also been given in support of the fact that elephants recognize roads and attempt as much as possible to spend the least amount of time on the road while crossing. The study has also considered six (6) roadless reserves which is very good as behavior of elephants could be influenced by many factors including environmental conditions. Inclusion of six sites removes the possibility of making wrong deductions influenced by other factors other the factors under study.

Gaps of the Paper

The weakness of this paper is that it has not considered other factors that may affect elephant's behavior while crossing roads. Factors such as noise from adjacent areas could also have effect on the movement speed of elephants and the authors have not explored this possibility.

The paper has also not considered elephants of different ages. Young elephants may have not experienced as much challenges as older elephants hence could react differently to situations in comparison to older elephants. Male lone elephants also react differently from those on a herd and this factor was not considered in the study.

Recommendation

A study be undertaken to investigate other factors that may influence the speed of movement of elephants while crossing roads to be sure that it is the risk associated with roads that causes the increase in speed. In addition it will be beneficial to include elephants by age set or group in the study so that it can be ascertained whether young elephants would react differently from older ones.

Article 2: Habitat use and the preferences by the African elephant outside of the protected areas and management implications in the Amboseli Landscape, Kenya. International Journal of Biodiversity and Conservation Vol. 7(3), pp. 211-236[2]

This article is authored by Moses MakonjioOkello, a Professor and specialist in wildlife management. He currently works in the School of Field Studies (SFS) Centre for Wildlife Management Studies (CWMS). Stephen Njumbi and James Isiiche are experts in wildlife management working with International Fund for Animal Welfare (IFAW) while John Kiringe is a practitioner working in the School of Field Studies (SFS) Centre for Wildlife Management Studies (CWMS).

Elephants are large herbivores with females weighing up to 3 tons while males weigh up to 6 tons. Despite their huge bodies, elephants have poor digestive efficiency with much of the food ingested being passed out inform of droppings. Elephants have been found to be wasteful feeders. Due to their great effect on the vegetation, elephants are regarded as drivers in alternate states in the ecosystem and are comparable to wild fires in this aspect. Given their need for large

amounts of feed, elephants tend to include a lot of low nutritional plants in their diet especially considering the fact that these are more readily available. Water and landscape heterogeneity are believed to determine the range of elephants especially in the savanna areas since elephants water intake is very high.

Purpose of the study

To investigate the use of habitat by elephants and the elephant attributes that determines the use and choice of habitat types

Study objectives

1. To establish the proportion of various habitats found in the landscapes used by collard elephants in the Amboseli ecosystem
2. To establish the frequency of habitat use by elephants in their home range in their landscape
3. To establish elephants selection of the habitats by comparing the habitat proportion available and frequency of use for each habitat by the elephants

Methodology

Six collard elephants were used in the study. Collard elephants were tracked using GPS system during dry season and wet season. A total of 129 points used by elephants during dry season were sampled while during wet season a total of 131 points were sampled. 10 randomly 1 km transects were established in each elephant general home range. The random points of each actual elephant location in the habitat was considered as actual usage of forage in that location.

This methodology is well provided herein but it lacks in the sense that the elephants have not been categorized into different age-sets or male and female elephants. Male elephants especially the solitary ones show a slightly varied behavior from elephants in a herd. This important distinction is missed out in the methodology.

Results

Four vegetation types were identified in the research area which are bush land, woodland, grassland and swamp. Out of the four habitats it was observed that elephants preferred bush land and woodland spending about 70% of their time bush land and 30% in the woodland.

Location A had 70% bush land and 20% woodland, Location B had 60% bush land and 10% wood land, Location C had 60% bush land and 30% woodland, Location D had 60% bush land and 30% woodland while Location E had 60% bush land and 20% woodland.

The study noted that there were no variations for male and female elephants neither was season important for selection of habitat. Selection of habitat was found to be dependent on habitat type. There was consistency in the use of the two habitat types by elephants.

The Study concluded that neither season nor individual animal traits influenced habitat selection by elephants. This was mainly influenced by habitat type. This implies habitat selection does not vary from one elephant to another and therefore generalization for all elephants is valid. However, Quality of feed, quantity and risk to elephants seem to have more influence on the habitat or range selection than the other elephant characteristics. Risk to elephants is mainly in form of human developments such as settlements within or near wildlife areas and also poaching. It is therefore clear that season nor animal traits has anything to do with habitat selection but the risks which are mainly human induced.

Strengths of the study

The study has clearly documented its methodology which makes it very easy for other researchers to replicate results under similar conditions. The purpose and specific objectives are also very clearly documented in the study.

Weaknesses of the study

This study is weak in the sense that it concentrated on one kind of ecosystem. Elephants occupy different habitats such as forests and arid and semi-arid zones. This study would have been stronger in its conclusions if it considered at least two different habitats or ecological zones occupied by elephants. In addition, the study concentrated on a fairly small number of individual elephants to draw its conclusion. There were only two female elephants and 4 male elephants collard and used in the study.

Gap of the study

The study documented existence of a number of risks to elephants in the study area such as evidence of presence of snares, elephant carcasses, and carcasses of other large mammals. Livestock especially cattle, goats and sheep were also reported to share range with elephants. In general livestock will use grasslands and marshy areas which the study found to be shunned by elephants.

The study also failed to distinguish elephants used in the study into age-sets and also solitary males and those in herds. This implies that different behaviours exhibited by the different categories could have been missed out because the animals were not differentiated from the start of the study.

Recommendation

There is a need to carry out further study to determine the effect of livestock and other wildlife on elephant's selection of range. This is because elephants could be avoiding range used by livestock as a way of avoiding direct interaction which puts their lives in danger.

Article 3: Elephant behavior and conservation: social relationships, the effects of poaching, and genetic tools for management Molecular Ecology (2012) 21, 765–778[3]

This article on elephant behavior and conservation is authored by two scholars namely Professor Archie A. Elizabeth, an expert in evolution of social behavior in animals and Chiyo Patrick who is an expert in zoology, evolutionary biology and animal communications. Both scholars are from the department of Biological Sciences, University of Notre Dame, USA.

The authors argue that genetics are very important for understanding the breeding, dispersal and cooperation of animals which would be difficult to uncover using behaviour alone. Conservationists also rely on genetics to provide key information on population size, disturbance or forensics. In the African situation, genetics has been used to provide information to managers, understand consequences to animal social behaviour to learning how poaching alters elephants social and genetic structures. The authors further argue that elephants are of great significance in the African case given the fact that poaching reduced their numbers from about 1.3 million to about 600,000 in less than a decade between 1970 and 1980. The poaching mainly targeted large older elephants because of their tasks. The risk to elephant populations has again resurfaced with increasing land fragmentation and human wildlife conflicts. It is based on this understanding of threats to elephants that the authors argue that "understanding of elephant social behaviour shapes and is shaped by genetic structure, and how humans are changing those relationships, in necessary to conserve wild elephants".

Purpose of the study

The Authors acknowledge that elephants are affected by many factors but they restricted their study to human impacts, especially poaching, on elephant societies, population genetics, and conservation.

Objectives of the study

To explore whether kinship predicts the strength of elephant social relationships, and how poaching changes the strength and quality of these relationships.

To examine which factors predict patterns of male reproductive success and inbreeding avoidance, and how poaching changes these patterns.

To assess the utility of genetic tools for elephant conservation and management.

Results

Kinship, elephant social relationships and the impact of poaching

The study observed that female elephants remain together with their kin even at adulthood as opposed to male elephants that roam around looking for mates and in most instances never rejoin their kin permanently. Males can associate with each other but for very short periods mostly not more than 10% of their time. In populations not heavily impacted by poaching such as Amboseli

national reserve elephants retain very strong kinship ties as opposed to populations impacted by poaching.

The study realized that males related genetically formed ties and the same applies to females which lead to conclusion that genetics has a role to play in the elephant groupings and ties. However, it was noted that ties do form between unrelated members but the ties of related elephants was much stronger.

Male reproductive success, inbreeding avoidance and the effects of poaching

In elephants, males never join a social group permanently but roam around searching for mates and siring off-springs across the population. In fact it is noted that females rarely sire off-springs with the same male twice. Female elephants are sexually receptive for a few days every 3-6 years because they gestate their calves for 22 months and nurse those calves for 2 to 3 years.

Since males search for mates across the population there is a possibility of returning to their natal group resulting in inbreeding. Male elephants grow for their entire life and a 50 year old will be much bigger in mass and height than a 30 year old. Older males also show musth, a physiological state where males have elevated testosterone, aggression, and sexual activity. Younger males experience musth for shorter periods compared to older males. Males in musth outrank all other males not in musth regardless of size and age when it comes to breeding.

Poaching disrupts elephants breeding behavior because when the older males are poached then the younger males start to breed at an early age. Conversely when a few older males are left they lack the natural competition and dominate the breeding scene such that almost all calves are sired by very few old males given the fact that breeding success is dependent on age and musth state. Older males stay in musth for 2-3 months as opposed to younger males that experience musth for a few days.

Genetic tools in elephant management

The authors have noted that "while genetic tools are important in revealing the patterns of social relationships and reproduction in elephants, genetic methods have also contributed key information to managers and conservation biologists about elephant population size and forensics. As such, elephants provide a valuable case study for the use of genetic tools to conserve other social species". Based on this, the authors used genetics to accomplish 3 objectives that are;

1. To monitor the populations of elusive forest dwelling elephants
2. To understand the behavioral ecology of crop raiders
3. To track sources of illegal ivory in the market

The reason why scientists use genetics to estimate the elephant populations is because at times it becomes difficult to successfully undertake aerial counts especially in woodland or forest habitats. In such a case dung counts or molecular genetic census techniques come in

handy.Human –wildlife conflicts do accelerate extinction of already declining populations. Local communities in most cases do kill crop raiders resulting in genetic losses. Management strategies have targeted specific crop raiders to mitigate conflicts. However this becomes very difficult in instances where crop raiding happens at night and during the day crop raiders cannot be easily identified. In such cases, feces from crop raiders in raided farms are used in non-invasive genetic tools to pick out the culprits.

Genetics is used to identify sources of ivory especially when the same is suspected to have originated from prohibited sources. Elephants occupying certain ecological zones, grasslands or forests and minerals in the soils have different carbon isotopes. Using genetics it is therefore possible to identify with a very high degree of accuracy the likely sources of ivory and appropriate action taken.

Strengths of the study

This study has used different approaches in determining the elephant behavior which eliminates the possibility of erroneous conclusions. It is therefore very strong on exploring the effects of kinship ties, breeding and use of genetics to manage this important resource. The angles from which management of the elephant resources can be approached have been clearly presented and indeed the article is a must read for conservationists specializing in elephant management.

Weakness of the study

The study concluded that bonds between males are predictable but weak. In fact males rarely spend more than 10% of the time with other males. In this case the study has failed to indicate whether the 10% of the elephant's time is in relation to its entire lifetime or it is within a specific period of time. It therefore leaving the reader guessing what the authors intended to convey which can easily result in misinterpretation.

Recommendation

The study has observed that elephants avoid inbreeding but failed to indicate how this happens. I therefore recommend a study be undertaken to determine how elephants recognize their close kin separated from them many years and avoid inbreeding.

Article 4: Physiological Stress and Refuge Behavior by African Elephants. PLoS ONE 7(2): e31818. doi:10.1371/journal.pone.0031818[4]

This article is authored by two scholars from the University of Missouri, in the United States of America namely Jachowski and Millspaugh in conjunction with Slotow R from the University of Kwazulu Natal South Africa. The article argued that vertebrates including elephants do react by releasing stress hormones that help them survive or overcome the effects of stressors. However, stress is detrimental to elephants when they get exposed for extended durations. This exposure can be limited through the following mechanisms; the individual exhibits escape behavior away from the perturbation; the individual remains in the area, but identifies and uses a refuge to avoid

the perturbation; and the individual identifies and uses a refuge, but will move outside the refuge during periods of non-disturbance. The authors have noted that elephants have been exposed to restricted ranges due to actual electric fences or other developments by human beings that have restricted movements. In South Africa elephants have been trans-located to about 58 protected zones using processes considered least unobtrusive. However, it is noted that elephants still experience trauma lasting up to about 30days post-release after translocation. Based on this, Wildlife managers have been advised to develop refuge areas where elephants can shelter during such periods which helps reduce human-wildlife conflicts.

The purpose of the study was to examine spatial and temporal hypotheses of refuge behavior in elephants by comparing space use patterns among three restored elephant populations.

Materials and Methods

Three fenced wildlife management areas were selected for this study.

The researchers in an effort to determine the refuge hypotheses that elephants with high Fecal Glucocorticoid Metabolite (FGM) levels exhibit restricted space use, they compared the proportion of a reserve utilized by elephants among reserves.

To evaluate the temporal refuge hypothesis, that elephants with elevated FGM levels exhibit different behavioral patterns in day and night, they compared day home range size to night home rangesize within each reserve.

Results

It was observed that elephants in all selected project sites exhibited refuge behavior preferring to restrict their range during the day when interaction with man was most certain to ranging widely at night. This kind of behavior was not evident in forest and woodland areas where human activities were minimal.

The study further observed that the elephants with constant exposure to stress exhibited behavior that led to under-utilization of space available within the elephant range area. This was quite different from elephants that had experienced short-term stress exposure in most cases through translocation. This category of elephants although took refuge during initial periods they adapted to the situation and started utilizing the full range available to the animals.

According to the study, traumatic events that exposed elephants to stress hormones includes Poaching, Hunting, Wild fires, Tourism and Translocation. Other human disturbance stressors such as forest plantation workers in different areas/ strands of the forest caused elephants to avoid those specific areas for those periods. However, this was short lived and as soon as the plantation workers exited from the area of their operations then elephants were noted to make use of that space.

Strengths

The article has documented the methodology used which enables verification or replication of the results as may be required. The purpose has been well documented and the results presented in a very simple and easy to understand format making the article available to all cadres of users.

Weaknesses

The study has not provided a justification as to why it selected 3 wildlife management areas that were fenced and had a big number of the elephants trans-located from other Kruger National park.

Recommendations

This review recommends a longitudinal kind of study aimed at establishing the long term behavior of the elephants in response to the stressors that were observed in the study. Since elephants exhibited different kinds of reactions such as short term avoidance of specific locations as reaction to a given stress element it is important to identify the duration that such behavior is likely to be exhibited by elephants especially where stressors are of long term/chronic nature.

Article 5: Responses of African elephants towards a bee threat: Its application in mitigating human–elephant conflict. S Afr J Sci. 2016;112(1/2), Art. #2015-0058, 5 pages. http://dx.doi.org/10.17159/ sajs.2016/20150058[5]

This article is authored by 5 scholars among them Ndlovu who doubles as a lecturer in the University of Witwatersrand in South Africa and the Organization for Tropical Sciences. The other 4 authors (Devereux, Chieffe, Asklof and Russo) are also scholars in the Organization for Tropical Sciences in South Africa. The authors have argued that Southern Africa region accounts for about 40% of the African elephant total range area. Elephant numbers have also been increasing considerably within the protected areas while land outside protected area has steadily been converted into farmlands and settlement areas. This has been a cause for violent human elephant interactions. Farmers have for long tried many strategies to keep elephants at bay with little success hence the need for a better strategy. Elephants have very good hearing capabilities and sensitive olfactory systems which enable them pick sound and smell at very high rates. Elephants have also been found to have very sensitive skin under the trunk, behind ears and around the eyes that easily harmed by African bees.

Earlier studies that played audio bee recordings to elephants found that elephants would react defensively including shaking head and dusting all aimed at preventing bee stings.

Purpose of the study

Toexplore the efficacy of using African honey bee (the bee species found in Kruger National Park) presence to deter elephants.

Study hypotheses

The presence of bees exhibiting a single cue, either olfactory or auditory, is sufficient to deter wild elephants.

Materials and Methods

The study used experimental design. The researchers used honey and African honey bee buzzing noise from Kruger National park. Other control noise used was that of natural waterfall. The experiments were as follows;

1. Honey scent alone
2. Honey and angry buzzing African honey bees

3. Waterfall noise (control)
4. Waterfall with Honey scent
5. Buzzing bees noise only

Honey (50 Ml) was dissolved in hot water and sprayed using 500 Ml hand spray in the direction of target elephants and reaction observed. This was repeated with control noise (waterfall) accordingly. The bee buzzing noise and waterfall noise were played using standard equipment mounted on researcher's vehicle.

89 elephants were sampled in the study area. It is noteworthy that African bees are notoriously territorial and have large defensive perimeters surrounding their hives. For this reason any disturbance or movement around the defensive distance to the beehive is seriously challenged by the African Honey bees.

Results and discussion

In the experiments it was realized that African honey bees buzz combined with honey scent elicited defensive reaction from the elephants which in most cases took off from the origin of the stimuli. This was mostly associated with an active bee hive. The scent of honey alone did not elicit strong reaction from the elephants and so was the buzzing noise of African bees without scent. The other treatments were not eliciting any serious reaction from the elephants.

Strengths of the study

This study is very strong in the methodology used and the appropriateness of the research in identifying elephant reaction to different stimuli with a view to managing them. The authors have clearly explained their findings and made it clear and easy to understand using simple explanations.

Weaknesses of the study

This study has mainly concentrated on the reaction of elephants when exposed to different treatments as per the experiment design. However, it should be noted that wild beehives are not so many in various wilderness areas. It therefore implies that few number of elephants could have had encounters with active beehives. Since this is the fact, it therefore implies that some of the elephants exposed to the treatments could have never had an encounter with active beehive and therefore the treatment meant nothing the animal's hence inadequate response.

Secondly, the goal of this study was to identify methods through which elephants can be managed or controlled in terms of crop raiding. The African honey bees that are being targeted to serve as the control for the elephants are known to be very active during the day and dormant during the night. On the other hand, African elephants are very active crop raiding during the night when human activity is minimal. It therefore holds that the findings of this study will not meet intended objectives of controlling the crop raiding by elephants because it did not adequately understand the behavior of bees from the onset.

Gaps in the study

The study did not have baseline information on the life history of the target elephants especially in relation to encounters with African Bee hives. In this case their findings may have been

inadequate as the assumption made that all elephants had experience with encounters with active bee hives is false.

Recommendations

It is recommended that study methodology be revised to include obtaining baseline information of elephants from the time they are born with a view to picking out elephants that will have got encounters with African Honey Bees and those that will not have had such an encounter. This will lead to better findings in terms of elephant's reactions to the Buzzing noise of bees and the honey scent used in the study.

Areas of Convergence between the five articles

The articles reviewed have convergence in terms of assessing reaction of elephants when subjected to external stimuli occasioned by human actions or activity. The first article by Blake *et al* entitled "Roadless Wilderness Area Determines Forest Elephant Movements in the Congo Basin" has explored the behavior of elephants while crossing roads in protected and unprotected habitats while the second article by Okello*et al* entitled "Habitat use and the preferences by the African elephant outside of the protected areas and management implications in the Amboseli Landscape, Kenya" has examined use of habitat in protected areas where activity of man is less compared to unprotected areas where human activity is intense. Effect of poaching by man has also been evaluated in the third article by Archie and Chiyo entitled "Elephant behavior and conservation" while the fourth article by Jachowski, Slotow and Millspaugh entitled "Physiological Stress and Refuge Behavior by African Elephants" has explored behavior of the animals (elephants) while under different stress situations. The fifth article by Ndlovu*et al* entitled "Responses of African elephants towards a bee threat: Its application in mitigating human–elephant conflict" has explored how human development (economic activities) especially bee-keeping affects the behavior of elephants.

All the five articles have concluded that human activity in one way or the other have direct influence on the behavior of elephants. The influence is either in terms of modifying behavior for the purpose of self-protection or preservation or relating to each other. The article by Jachowski*et al* for example has concluded that elephants take refuge whenever they are exposed to stressors and when stressors are short lived then elephants take refuge during periods when stressors are expected and re-occupy normal habitats continuing with their normal lives. This is also the finding of the Archie and Chiyo when they concluded that elephants take refuge from buzzing angry African Bees.

All the five studies have used quasi experimental design in undertaking the studies.

Areas of Divergence among the five articles

The article by Okello*et al* entitled "Habitat use and the preferences by the African elephant outside of the protected areas and management implications in the Amboseli Landscape, Kenya"

has the elephant habitat as its central focus while all the other four articles have the elephant as their central focus.

Conclusion and recommendations

All the five articles reviewed have examined the different reaction by elephants when exposed to different stimuli by human beings. The reactions by elephants vary based on the type and strength of stimuli. Elephants have good memory especially when it comes to identifying their kin and also remembering stressful situations encountered in the past hence react accordingly when similar situations face them. This has been well demonstrated by the elephant's reaction to the noise of buzzing African Honey Bees with honey scent that mimicked an active beehive. In summary, elephants are social animals and have predictable behavior given specific situations.

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