FLIGHT INITIATION DISTANCE IN THE PRESENCE OF PERCEIVED RISK FROM HUMAN: A CASE STUDY OF OLIVE BABOONS (*Papio anubis*) AT YANKARI GAME RESERVE

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ABSTRACT

The rapid increase in wildlife tourism may have led to the habituation of some species there by influencing their perceived risk of danger. To measure this, we estimate flight initiation distances of animals. Some primates have developed some dependence on humans for food, they spend more time around human settlements and forage less within their natural habitat, overtime this results in a conflict. We investigated the perceived risk of predation of in a population of olive baboons (*Papio anubis*) in Nigeria that have become dependent on tourists for food. We used an artificial deterrent – slingshot, used by an observer to approach groups of different compositions and at varying distances. Half of the groups were approached without a deterrent and the other half were approached with a slingshot. The flight initiation distance (FID) for each group sampled was recorded. We found that FID was positively correlated with age and group size of the baboons when approached with a visual cue. Due to a history of negative interactions between baboons and humans in Wikki Camp, this finding is important in the management of conflict.

Keywords: Baboon, Conflict, FID, Habituation, Yankari Game Reserve.
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INTRODUCTION

Human interference within pristine environments often leads to severe changes in species behaviour and population regulation mechanism [1]. Animals well adapted to urban areas have learned to cope with altered ecosystem patterns and processes, including changes in perceived predation risk and interactions with human. The altered landscape of fear can be easily observed and measured in the form of flight initiation distance (FID). One of the consistent risk-taking patterns is that well adapted urban animals have a much shorter FID than those in areas with minimal human presence. This behaviour has been widely attributed to an animals' habituation to humans, typically associated with non-lethal interactions responses or absence of the landscape of fear around human settlements [2 - 6]. In modified environments there is generally less concern towards animals with no "negative interaction". Continuous exposure to this non-lethal stimulus results in reduced responsiveness to human approach [7]. The impact of such habituation to humans is that appropriate anti-predator responses towards other predators may decrease [8, 9]. In the wild, primates seek out preferred or ephemeral food resources when foraging [10]. Many theories about the evolution of primate intelligence have emphasized the role of ecology in shaping cognitive abilities through natural selection. For example, complex spatiotemporal distribution of food, degree of environmental uncertainty, and use of extractive foraging techniques to acquire food have all been suggested as ecological conditions favouring the evolution of more complex cognitive abilities [11 - 16]. Foraging strategies can be influenced by predation risk, social interactions, and food availability. In addition, life-history traits, diet and the satiated state of the animal can further drive variation in foraging. Finding and locating food resources in the wild can be cognitively demanding. While foraging, individuals generally face three major challenges: (i) locating scarce and limited resources, (ii) intra- and inter – group competition [17] and (iii) avoidance of predators [18]. According to the concept of rule-based decision-making [19], animals can use a 'trial and error' strategy and/or different forms of social learning to create expectations and strategies (rules) to find solutions [20]. If a given tactic fails, the individual is expected to incorporate this information and try other tactics or make new decisions to overcome the problem [18, 21]. Components of decision-making can be inter-temporal involving trade-offs between time costs and the value of the rewards and, risky choices involving trade-offs between expected value and the probability of different outcomes. Such decisions are sometimes considered 'self-control' or impulsive [22], but value-based preferences may also be tailored to particular environmental contexts [23, 24].

Escape theory predicts that distance from which prey animal decides to flee from an approaching predator is governed by the decision to make a trade-off between risk of predation and benefits of maintaining any activity which directly affects the fitness of the animal [25, 26]. Predators adopt different strategies to get their prey (stealth or sit and wait), the choice of strategy cannot always be predicted. This puts a selective pressure on the prey to differentiate means of approach by the predator to optimize their escape strategy. Individuals who can

assess the direction of approach within a short time have a selective advantage, however, susceptibility of different species are related to the habitat, predator type [27] and predator density. The relationship between prey flight initiation distance and predator density has ecological relevance because it could potentially affect the outcome of interactions between prey and multiple predators [28]. Direct approach produces longer FIDs in different animal species [29]. Humans are often considered predators by these animals [30]. A lot of people are familiar with the impacts of human activities on species that are considered either endangered or threatened but impacts on abundant species are not easily identified or overlooked. Impact of anthropogenic factors such as habitat modification, noise pollution and level of habituation on vigilance and threat perception of baboons in YGR has not been widely studied.

MATERIALS AND METHODS

Study area

Yankari Game Reserve (YGR) is a premier game reserve in the North-eastern part of Nigeria which was gazetted in 1956. It covers an area of about 2,244.20 square kilometers (km2) which cuts across Duguri, Pali and Gwana Districts in Alkaleri Local Government Area of Bauchi state [31, 32]. This study was conducted at the Wikki Camp (Figure 1), which has a warm spring and safari that attracts tourists and residents to experience, a variety of primates, antelopes, birds and reptile's species. The Game Reserve has five warm springs of which the Wikki warm spring is the largest and most developed with a constant water temperature of 31.1^{o}C. The YGR consists primarily of a Sudan Savannah vegetation with transitions into a dry Guinea Savannah separated by River Gaji (deciduous woodland) [32]. The major watersheds found in the YGR are the Yashi and Gaji rivers and their tributaries.

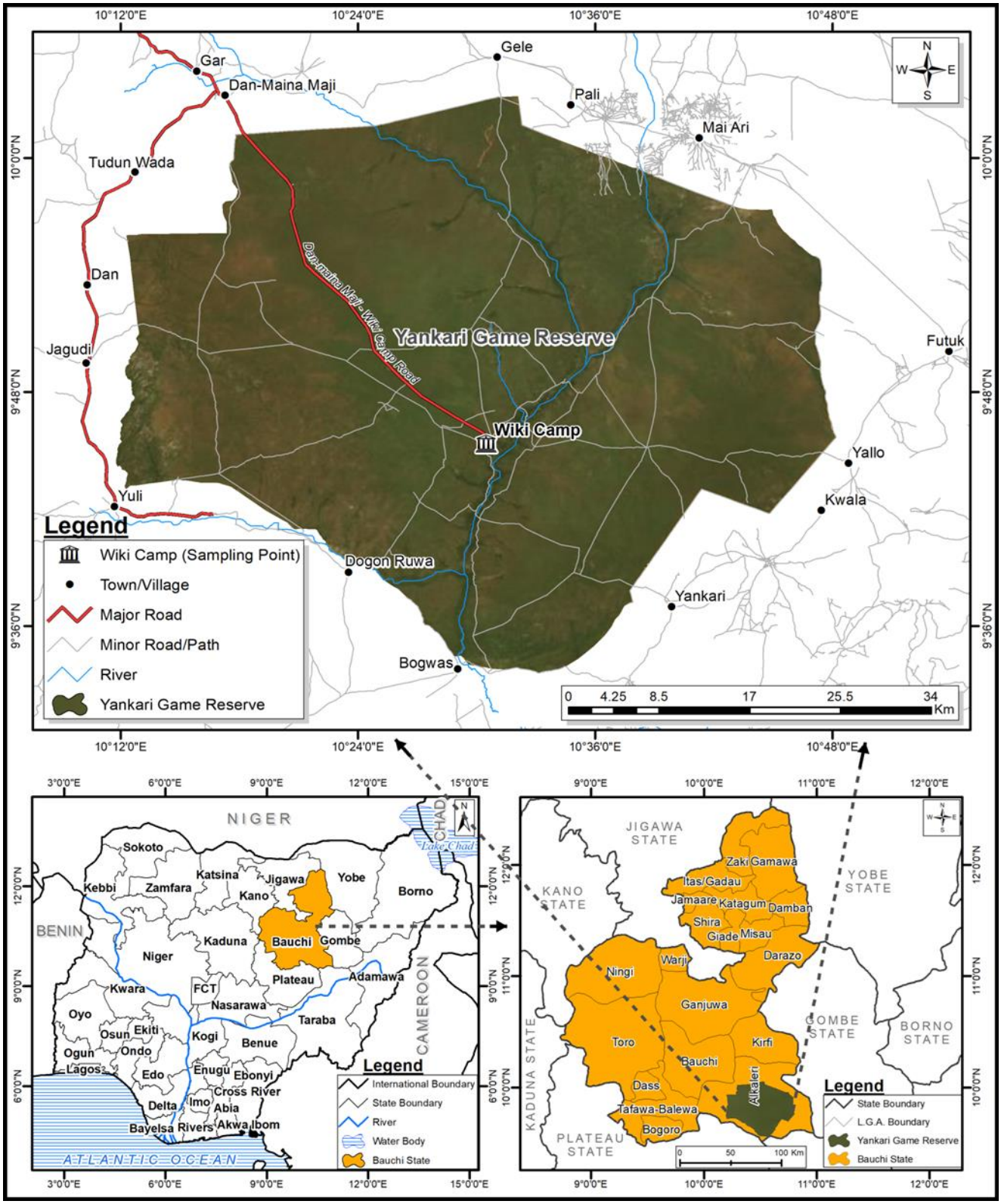

Figure 1: Map of Yankari Game Reserve showing Wikki Camp.
Source: Map Gallery, Geography Department, ABU, Zaria

Data collection

The method used by Mikula *et al*., [6] was adopted to measure FID with modifications. There have been instances of negative interactions between the baboons and tourist over the years which range from mugging to damages to properties which has earned them a nickname locally "area boys". The flight zone of a baboon was defined as the perimeter that if encroached upon by a natural predator or humans would prompt an alarm and escape behaviour. This zone is referred to as the FID [33]. FID was estimated as the number of long one-meter-long steps, from the point where the source of the stimulus (observer) is located to the point where the baboon initiates flight.

FID data was collected in May 2020, this period is the transition period from dry to raining season in Bauchi. The availability of natural food in Wikki Camp for the baboons was limited to the fruits of *Azadirachta indica*. Only individuals positioned on the ground and in open spaces were sampled to avoid the potential effect of vegetation structure or presence of cover on their risk awareness [34]. Group size was defined as the number of visible neighbours and is calculated as the number of individuals in the group at a distance of 10 meters or less between neighbours. Baboon troops engaged in affiliated activities and behaviour such as foraging and grooming were sampled. Because vigilance might be undertaken by older or more experienced members of the group, FID from any randomly chosen focal individual was measured and the same troop was not sampled twice during an observation session. A uniform starting distance of 40 meters was used during the direct approach of the baboon troops. We approached 32 of the groups sampled with a visual cue – slingshot and 23 without a visual cue. Because individuals are unmarked coupled with the high population of baboons within the study area, sampling could not be repeated could not be repeated on the same groups, therefore, each group was treated as unique. Two sessions were conducted in a day with the first session being 07:00h-10:00h and the second 14:00h-17:00h. Only one of the cues was used in a particular session and in a single day.

FID data was collected from groups located in the North, South, East and West of the camp. To minimize resampling of the same individuals, the next troop of baboons sampled during the same session were selected based on differences in group composition and at a distance not less than 100m from the previously sampled group. Data collection was conducted by a single observer to minimize bias. When approaching with the visual cue the observer did not indicate the intention to use a slingshot because the baboons learned the posture and motion of the observer. Effect of visual cue, group size, sex and age on FID was explored in which FID was the response variable, while the predictors include visual cue, group size, age and sex. An individual approach was used with each individual representing a single point in the analysis. We used a uniform starting distance of 40 meters for each approach. We sampled 55 baboons that consisted of 20 males and 35 females which were categorized into 25 adults and 30 juveniles from different groups at designated sites which were revisited throughout the study period.

Statistical analysis

The effects of visual cue, group size, age and sex of FID was determined using Generalized Linear Model (GLM) in SAS statistical software STAT 9.3. A t-test analysis was also carried out to compare the two different approaches – with a visual cue and without a visual cue on FID.

RESULTS

There were significant differences between approach with and without a visual cue (deterrent). The t-test analysis showed a very significant differences in FID when the two approach were compared ($p = 0.006$). When approached with a slingshot the baboons responded negatively by fleeing from the observer. The longest FID when approached with cues of slingshots was 4 meters while the shortest FID was 12 meters. Approaching without a visual cue- slingshot had no effect on flight initiation distance regardless of age, sex or group size delayed escape to potential threats from a human observer also showed short flight distances. Approaching without the slingshots, the longest FID was 21meters while the shortest was 36 meters. The Mean ± SD of FID were = 10.10 ± 4.40 meters and 33 ± 2.02 meters respectively for age of the baboons (Figure 2) adult baboons had longer FID compared to juveniles. Adult baboons recognize the threat posed by the observer with the slingshot faster than the juveniles and respond appropriately by seeking cover.

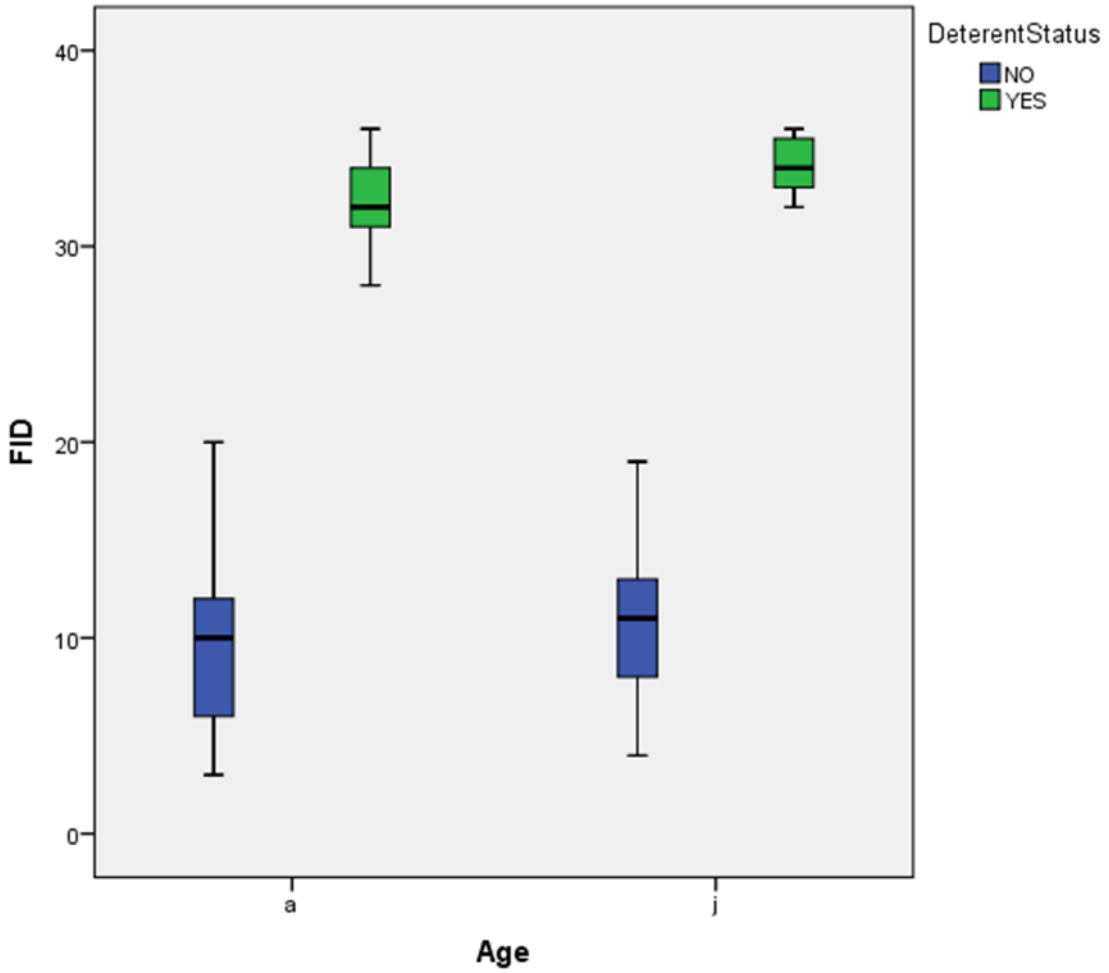

Figure 2: Flight initiation distance with and without a visual cue for different age classes adult and juvenile.

The presence of a visual cue is shown in green and the absence of a visual cue in blue.
FID was significantly positively correlated with age of the baboons ($p = 0.02$) and group size ($p = 0.04$) when a visual cue was presented (Figure 3).

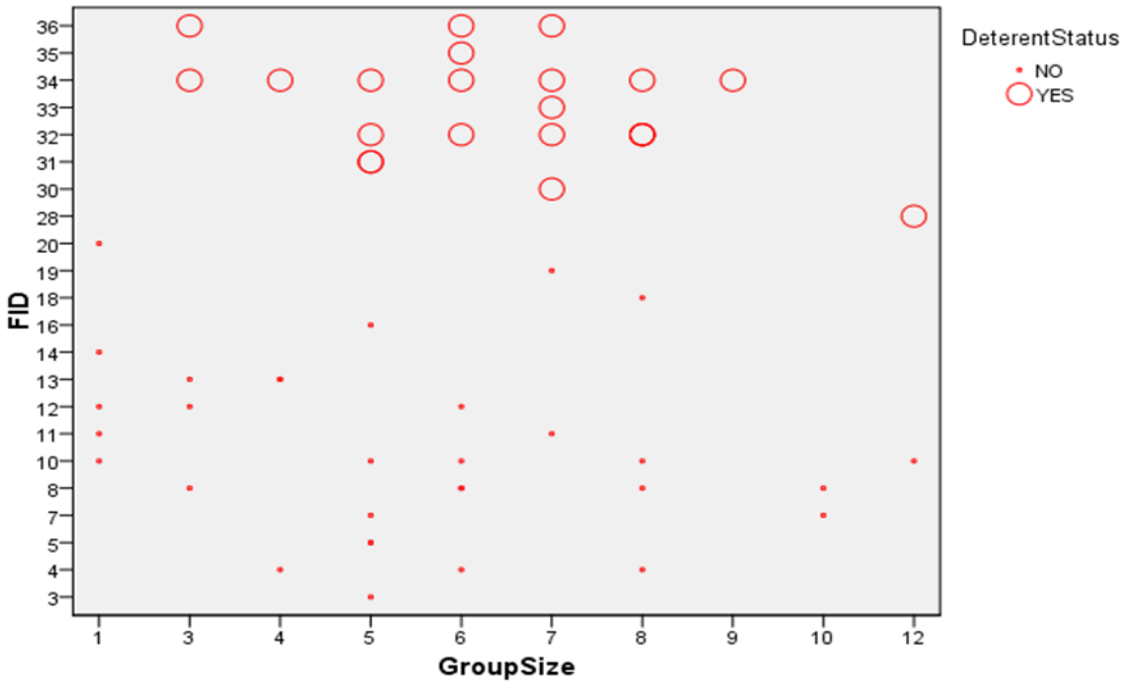

Figure 3: Scatterplot of flight initiation distance plotted against group size of the baboons. Circles indicate approach with visual cue while dots indicate approach without.

DISCUSSION

Threat Perception of Wikki Camp Baboons could be attributed to habituation, which has been a fundamental part of studies of primates for several decades [6, 35, 36]. Fleeing from observer when approached with a slingshot can be suggested that this response is a function of social learning where they associate a slingshot with danger. We observed that the slingshot as a deterrent to the baboon encroachment is allowed by the management of the reserve. This effect was the same all through the study. Allan *et al.* [26] reported that chacma baboons had the same level of tolerance to human approach even after a predation event suggesting the baboons still view observers as a high-level social threat. Predation events on baboons at the Wikki Camp have not been reported in years, this can be attributed to the fact that the population of their natural predators have been diminished significantly and the threats they face are directly from humans carrying deterrents.

Group size was positively correlated with FID when approached with a visual cue. This corroborates with observations made on cercopithecoid primates which have been found to have a positive correlation between predation risk and group size. Group size correlating positively with FID means the larger the group the longer the FID because the most vigilant individuals will alert the group of any threat. However, the effects of predation risk on group size are also likely to vary with the type of predator and substrate the group occupies i.e., terrestrial and/or arboreal [6].

Age and sex had no effect on FID of vervet monkeys Mikula *et al*. [6] while on the contrary, it was observed that that age had an effect on FID of Wikki Camp baboons with juveniles having shorter FID than adults. Personal observations in the field reveal that in the presence of cover, the adults delay in responding to the deterrent until the risk of danger increases when the observer closes the distance with the group. However, in open spaces, both adults and juveniles flee at the sight of the observer approaching. A study on habituated baboons showed that individuals always fled at the sight of workers from a local farm even in the absence of antagonistic behaviours such as chasing or throwing stones. On the other hand, when a researcher approached the baboons, they reacted positively which suggests that even in relatively stable environments where human-primate interactions are amiable, baboons can still distinguish between classes of humans and the potential risks they pose [26].

In human wildlife conflict, the use of conditioning by introducing aversive stimuli is much more common practice than conditioning by adding appetitive stimuli. Even though the latter may be ethically preferred, finding an effective appetitive stimulus is usually more challenging. For example, pain causes aversion while food might only be appetitive when an animal is hungry. Additionally, an appetitive stimulus (for example supplemental feeding) might artificially bolster the population, which could lead to more conflict [37]. In areas of

human wildlife conflict, higher FIDs would be expected but, in these scenarios, it is unclear whether FID measures are only measuring human risk perception or can be generalized to other threats such as natural predators. If the reduced FIDs found in areas with more anthropogenic disturbance are a reflection of the animals' landscape of fear, it would also be argued that habituation to anthropogenic disturbances can be transferred to predators of which there is scant information [26]. In YGR, the population of the natural predators of Olive baboons have been diminished significantly to the point where the Leopard (Panthera pardus) was thought to be locally extinct from 1987 and not until 2017 [38]. It should be noted, however, that when a behaviour is performed by an animal to acquire a resource that is essential to its health and survival (a biological imperative), for example because no alternative natural resources are sufficiently available, trying to make the unwanted behaviour less desirable to the animal will require considerable effort and it may be unlikely to extinguish the behaviour completely.

CONCLUSION

The result from this project suggests that olive baboons at Wikki Camp are very tolerant to human approach but a slingshot changes the risk perception of the baboons significantly by initiating flight at ≥30 meters distances. The absence of any evidence of predation from natural predators such as leopards and lions suggest there is need for further studies on the impact habituation of long-term absence of natural predators. Such studies will confirm if this population of baboons over several generations have no encounter with their natural predators due to a great decline in top predators or whether there is an age effect suggesting that some generations were exposed to natural predators at Wikki Camp in YGR.

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