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The Mechanism of Behavioral Adaptation of Gorillas (*Gorilla gorilla gorilla*) in Limbe Wildlife Center, Southwest Region, Cameroon

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Abstract: *Wildlife population decline due to habitat loss and poaching is a huge challenge to sub Saharan Africa, urging new conservation options such as captive breeding for possible re-introduction to the wild after a certain period. Wildlife seizure by the Ministry of Forestry and Wildlife is a strategy introduced by the government to protect and conserve wildlife species for possible re-introduction into the wild. The main objective of this study was to examine the behavioral activity of gorillas against their enclosure environment in Limbe Wildlife Center. Data collection was done for four months, February – May, and observations on the behavioral activities of gorillas were recorded from 7:00am-5:00pm each day of the month. The social behavior of gorilla divulged a significance X^2 = 29.044 df= 12 P = 0.004, X^2 = 48.97 df=20 P=0.000, and X^2 = 11.297 df=12 P<0.05 on the position of the gorilla in the zoo enclosure, food type, and hygiene of the zoo enclosure respectively. More so, gorilla activity budget favored grooming 39%, movement 26%, eating 18%, and fighting 14% respectively. Originally, gorillas are herbivorous in the wild but in a captive environment they are confined to a feeding regime characterized with a spectrum of food variety; fruits 37%, leaves 27%, meat 23%, starch 9%, cooked food 4%, and tree-bark 1% respectively. Additionally, the animal behavior recorded a significance, X^2 = 11.658 df=4 P=0.02 on the animal reaction to zoo tourists. During tourists' visits, the physical appearance of the gorillas witnessed calm 69%, aggressive look 27%, and exhaustion 4% respectively. The training of wildlife experts in the Department of Forestry and Wildlife in the University of Buea in Cameroon is a huge boost to wildlife conservation achievement, together with the flexibility of Ministry of Forestry and Wildlife towards workers in-service training and incorporation of academician into wildlife population management programs is a green light to future wildlife population increase in protected areas. Limbe Wildlife Center is one of the key conservation institutions in the country and has had a longstanding history of protecting wildlife species seized from poachers for possible re-introduction program into the wild after a certain period, a component that has made this zoo very important to Cameroon government and the conservation world.*

Keywords: *Wildlife, Gorillas, Re-introduction, Feeding, Hygiene, Enclosure, Seizures*

1. INTRODUCTION

Zoos and aquariums are important cultural institutions aiming to attain four main goals: education, entertainment, conservation and research (Barber &Mellen, 2013). Indeed, zoos are promoting conservation initiatives via captive breeding, financial supports, or educational programs; are providing research opportunities to various scientific domains; and are especially trying to optimize their species' welfare (Barber &Mellen, 2013). One major challenge in zoos is to keep a balance between the goals of education and entertainment for visitors, and keeping exhibited animals safe from stressing elements that could compromise their welfare (Fernandez, Tamborski, Pickens, & Timberlake, 2009). Animal welfare is defined as the individual's ability to cope with its environment (Broom, 1986; Hill & Broom, 2009), and is a spectrum between good and poor (Broom, 1991). It can be scientifically measured, as there are many indicators of welfare that can be evaluated, for instance: behavioral measures (e.g. captive animals' activity budget similar to the ones in the wilderness,

presence or not of abnormal behaviors or stereotypies; change in behavioral patterns in different contexts), physiological measures (e.g. an increase in heart rate, blood pressure, or adrenal response indicative of stress), physical and mental health (e.g. presence of injuries or diseases that would indicate poor welfare), life expectancy, and reproductive success (Broom, 2007; Fraser, 2009; Hill & Broom, 2009).

As fragmentation and destruction of natural habitats continues, the potential for zoos to contribute to conservation and education has increased (Rabb, 2004). Most zoos list conservation and education as two of their main goals (Patrick, Matthews, Ayers, &Tunnicliffe, 2007), although many visitors report that entertainment is their primary reason for visiting a zoo (Reade &Waran, 1996). However, visitors may be more likely to engage in pro-conservation behavior, if they develop a positive connection to wildlife during a zoo visit (Skibins& Powell, 2013). Yet, there is limited quantifiable data surrounding animal-visitor interactions, even though they are a daily part of life in the zoo. Space can be a major limitation for many captive environments; currently twenty-six billion animals incorporating ten-thousand species are housed in captivity (Mason 2010). Whilst the aim of most of these captive environments is research, education, and conservation (Mallapur et al, 2002), the constraints of confinement and poorly enriched environments can cause stress and abnormal behaviour. Examples of such abnormalities include: stereotypies, excessive inactivity, deviant sexual behaviour, and abnormal maternal care (Carlstead 1991; Mason 1991; Wiepkema&Koolhaas 1993).

Many animals in captivity perform abnormal behaviors known as “stereotypies” (Carlstead, 1996). Stereotypic behavior can be described as a pattern of movement such as pacing and head bobbing that is performed repeatedly, is relatively invariant in form, and has no apparent function or goal (Carlstead, 1996). Such behaviors are rarely seen in wild animals; therefore they are considered an indication of stress. Stereotypies occur in many species and are thought to have a variety of causes. For example, they may arise when animals are consistently unable to reach a goal, such as natural feeding behavior (Carlstead, 1996; Rushen and de Passille, 1992; Sheperdson et al., 1993). Sheperdson et al. (1993) found that captive felids often spent the time prior to feeding performing stereotypic pacing behaviors. Duckler (1998) found that the skulls of captive tigers had distinctively malformed external occipital protuberances that are not found in wild specimens. These were caused by excessive grooming behavior in the captive tigers and a reduction in the jaw muscles due to eating processed food (Duckler, 1998).The limitation of space is thought to be another cause of stereotypic behavior. In most cases, the smaller the enclosure, the more likely the animal will display stereotypies (Carlstead, 1996). However, it would be difficult to determine the exact amount of space that an animal needs to avoid developing stereotypic behaviors. Draper and Bernstein (1963) found that changes in the physical dimensions of the captive environment were often accompanied by a marked change in behavior. Lyons et al. (1997) studied the behavior pattern of 19 captive felid species and found that the cats in relatively larger enclosures had a higher level of exploratory behavior.

Behavioural observations are useful to record how enclosure design influences the activity budget of animals in captivity (Reinhardt et al. 1996; Monte &Pape 1997; Seidensticker&Forthman 1998). Individuals acclimatize to change in their environment, by amending the amount of time spent performing different behavioural activities (Firol-Jaman& Huffman 2008); but these often vary across age and sex in accordance with physiological and social needs. Few performances of species-specific behaviours suggest that the observed enclosure design and captive habitat are poorly enriched and lacking stimulation, causing animals to express stereotypic behaviours in replace of their natural behaviour. Stereotypic behaviours have diminishing effects on the welfare of animals which perform them (Mason& Latham 2004; Mason et al. 2007), they are caused by variable contributory factors which are partly species dependent. Zoo animals are not bred for adaptation to captive conditions but specifically to avoid this (Carlstead & Shepherdson 2000), weakly enriched enclosures therefore may not be enough to stimulate the appropriate „normal“ behaviours which you would expect from a wild conspecific.

Agonistic interactions play a small role in gorilla society, but are still worth considering when examining social structure (Watts, 1993). With such a naturally low frequency of aggression, determining rank solely based on agonistic interactions provides a largely incomplete picture of females' interactions and loses the context of observed aggression (Watts, 1993). When agonistic

interactions do take place, females will respond to an aggressive encounter with aggression rather than submitting to their aggressor in the majority of cases (Watts, 1993). Although rare, female agonism has been most often observed in cases of food competition, which results from occasional resource scarcity. Agonism as a result of food competition comprises about 66 percent of all conflicts observed among wild female gorillas (Harcourt and Stewart, 2007).

With specific regard to western lowland gorillas, increased frugivory gives rise to competition for fruit that is usually patchily dispersed, which results in differentiated social relationships among females (Doran and McNeilage, 1998; Stokes, 2004; Tutin, 1996). In some cases, there is cooperation during food acquisition, which is most often seen among relatives. Family cooperation is often an important factor in being both socially and reproductively successful in the group (Harcourt and Stewart, 2007). For instance, mothers might help their young offspring gather food. In captive settings, food resources are never scarce. However, their manner of presentation can result in competition among the individuals living in the same family group. Work by Scott and Lockard (2006) noted that in cases where food or enrichment items were highly desirable and/or distributed in a manner that made them physically defendable, clear social hierarchies resulted.

These hierarchies were evident by frequent agonistic gestures and vocalizations from higher-status females directed at subordinate females. As seen in wild populations, the females exercising their right to food were older and had been a part of the group longer than the subordinates (Scott and Lockard, 2006). Reconciliation reinforces the strong bonds that are necessary in group life. One study of captive western lowland gorillas noted little evidence of reconciliation in female-female quarrels. These results are surprising because western lowland gorilla females spend much more time with other females than with males, and thus strong social bonds are necessary. Moreover, because captive gorillas lack the space that wild populations have, they have a greater need to maintain positive relationships with group mates. It is believed that given a greater number of observations and a larger range of study subjects, captive western lowland gorilla females would, in fact, reconcile (Mallavarapu et al., 2006).

Zoos have contributed to the conservation of many wildlife species, especially those declared endangered and threatened. However, the additional components like public entertainment, breeding, and education have made zoos extremely important to the society. In ancient times zoos were owned by royal and noble families, but not for conservation reasons. Nonetheless, transformation of zoos to entertainment centers through tourism is a sustainable factor to achieve conserve ation goals. Limbe Wildlife Center is one of the key conservation institutions in the country and has had a longstanding history of protecting wildlife species seized from poachers for possible re-introduction programs back into the wild, a component that has made this zoo very important to Cameroon government and the conservation world.

2. MATERIALS AND METHODS

2.1. Description of the Study Area

Limbe municipality is located between latitude 3°57' - 4°27' N and longitude 8°58'-9°24'E (fig.1). The Zoo is found at the center of the city, established in 1993 by Cameroon Government and the Pandrilus Foundation. The zoo location is crossed by roads, and situated near Limbe City Council(Melle et al.2017). All species harbored in this place had been donated by the local hunters or confiscated by the Government of Cameroon. Limbe Wildlife Center primarily helps to rescue these species and later reintroduce them to the natural environment in mount Cameroon national park(Melle et al.2017). The climate of Limbe area including the reintroduction site, Mount Cameroon National Park is characterized by a period of heavy rains occurring from the months of June to October, and a dry season period extending from November-May. At lower altitude, the annual rainfall ranges from 1,000 mm^3 at Cape Debundscha to less than 2,000 mm^3 in the north-east around Munyenge area. The mean annual rainfall decreases with altitude to approximately 4,000 mm^3 at 1000 m and less than 3,000 mm^3 above 2,000 m (Payton, 1993).The temperature falls with increasing elevation where mean air temperature is 26.78°C, with monthly values ranging from 24.98°C in August, the rainiest month. Payton (1993) points out that, the humidity remains at 75 to 85% due to the influence of marine ecosystem. The zoo is enclosed with a strong wire-net fence with an estimated height of 10 m and a circumference of 400 m^2.

Limbe Wildlife Centre in Cameroon is a highly-respected sanctuary for chimpanzees, gorillas and other primates, with an extensive local outreach and education programme. Its dedicated team currently cares for more than 140 animals that have been confiscated from the pet trade, many of which are bush-meat orphans, babies whose families have been killed for food. Limbe Wildlife Center provides a long-term solution for confiscated wildlife. Working with the local and international community, Limbe aims to secure the survival of the endangered wildlife species of Cameroon. Where possible, confiscated animals are released back into the wild but for many species such as apes, finding suitable habitat, free of threat but with room for new populations to be introduced, is challenging.

Fig1.*Map of Limbe (Melle et al.2017)*

2.2. Data Collection

The research data on gorillas was collected during a period of four months, February - May, each day of the month. Preliminary non formal observation was carried out to determine the behavior categories of the subjects (Md-Zain et al., 2008b). Preliminary observation is critical for the observer to be familiar with the subjects and their behaviors, thus enabling them to choose the right measures and recording methods (Martin and Bateson, 1993). Martin and Bateson (2007) define "instantaneous scan sampling" as when "a whole group of subjects is rapidly scanned, or "censured," at regular intervals and the behavior of each individual at that instant is recorded." Behavioral data can be collected in several ways (Altmann, 1974). In categorizing these methods, Martin and Bateson (2007) distinguish between sampling rule (whose behavior is watched and when) and recording rules (how the behavior is recorded). Hence, data were collected on the gorilla activities in the zoo and ecological parameters during these activities.

2.3. Data Analysis

Research data, entered into eco-data sheets was assembled and analyzed by using statistical tools, such as chi-square (X^2) and percentages for both inferential and exploratory analysis. The behavioral activity of gorillas, such as movement, fight, rest, and groom were tested against position of the gorilla in the zoo enclosure, food type, hygiene of the zoo enclosure, gorillas' reaction during tourist influx respectively.

3. RESULTS

The social behavior of gorilla divulged a significance $X^2 = 29.044$ df= 12 P = 0.004, $X^2 = 48.97$ df=20 P=0.000, and $X^2 = 11.297$ df=12 P<0.05 on the position of gorillas in the zoo enclosure (fig.2), food type (fig.3), and hygiene of the zoo enclosure respectively (fig.4). Gorillas are tropical endemic apes that are considered endangered by IUCN, hence, should be conserved and protected in order to

prevent extirpation and possible extinction in future. Cameroon is rich in the population of western lowland gorilla (*Gorilla gorilla gorilla*), however, recent studies have revealed a rapid population decrease of the species of apes probably due to poaching and habitat loss on cultivation. Hence, seizure of live wildlife, especially endangered species by conservation stakeholders is a common practice in Cameroon. All the gorillas in Limbe Wildlife Center (LWC) were seized from poachers for their population increase and a possible future re-introduction into the wild. This conservation strategy, nonetheless, is the only principal means of protecting live gorillas that are found to serve as domestic pets in people's homes. But the captive behavior of gorillas is different from the wild activity since movement and enough self-control is restricted by the captive enclosure. Additionally, frequency of visitors into the zoos might have also contributed to expose a very shy primate to a certain degree of agonistic and aggressive behaviors which sometimes were observed manifesting in their social organization.

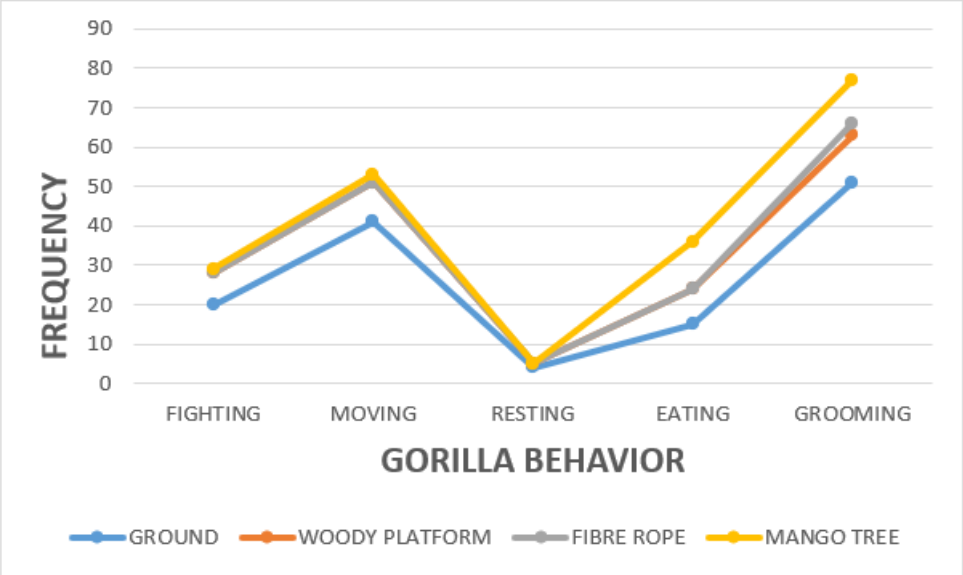


Fig2.*Gorrilla behavior and their position in the zoo enclosure*

In the wild, gorillas budget more time on feeding whenever they stumbled on a rich food location, however, food scarcity can trigger a movement activity to dominate the day budget. In captivity gorillas are compelled to feed only when food is provided by the zoo management, creating upset to the normal activity budget. Cases of extreme feeding with little movement activity had been known to obese gorillas in captivity, especially when their average daily feeding quantity is neglected. In this study, gorillas' activity budget favored grooming 39%, movement 26%, eating 18%, and agonistic fighting 14% respectively (fig.5).Nevertheless, the gorilla group in-fighting might depend on factors like feeding and mating competition because adult males and sub-adult males who should have left the group to other groups in the wild are still confined in same enclosures. Having many silver-backed gorillas in a single captive enclosure would provoke a lot of resistance and violence in the group. The high rating of grooming might be to reduce violent fights within the group since the enclosures are getting smaller to accommodate all the gorillas. Rest 3%, witnessed a very low rating in this zoo, reasons might be based on feeding competition order, that may depend on the daily food-quantity provision. Averagely, an adult gorilla consumes about 18kg of vegetation per day, however, gorilla feeding should not be compromised in captivity and their number should be considered in making feeding programs. Insufficient feeding would not only affect other budget activities, rather, provocation of violent fights that could disrupt and affect the behavior and peaceful atmosphere of other wildlife in the zoo.

Fig3.*Gorilla behavior and food type*

Originally gorillas are herbivorous, but in captive environment they are confined to a feeding regime characterized with spectrum of food variety; fruits 37%, leaves 27%, meat 23%, starch 9%, cooked food 4%, and tree-bark 1% respectively (fig.6). A clear indication that gorillas are flexible to feeding adaptation. In Limbe Wildlife Center, gorillas are healthy, a sign of satisfaction to an extent, though, much still needs to be done on their population management, especially if objectives are to increase their population for future re-introduction into the forest, then the endemic wild feeding regime must be given priority.

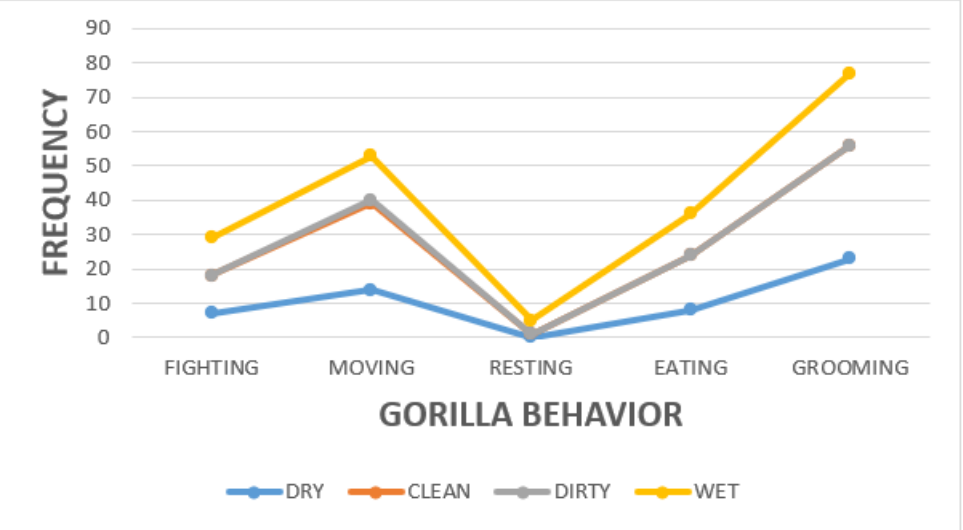
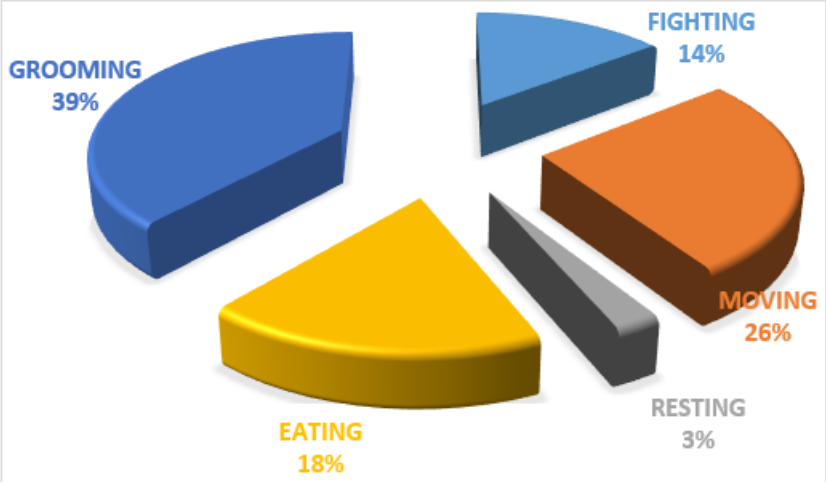


Fig4.*Gorilla behavior and the hygiene of zoo enclosure*

The zoo hygiene is a management priority in Cameroon because of human health concerns that could easily be adulterated by zoonotic diseases from wildlife especially primates such as gorillas. However, quarantining zoo animals against a spectrum of many infections is expensive and sometimes neglected. The study recorded clean-wet enclosure floors with many gorilla activities compared to the dry and dirty enclosure floors. Wild gorillas are clean, hence a dirty enclosure floor would be a discomfort to the activities of these animals, more so, could attract infections. Wild gorillas do not have specific niches like many wildlife species, their daily activity determines their new sight for a night. Neglecting, a clean enclosure for captive gorillas might be chaotic to their health, a possible dead end to human health safety and management of zoonotic infection



ns.

Fig5.*Gorilla behavior*

Also, the study registered gorillas active on all the available areas, mango trees, woody-platforms, fibrous ropes, and ground-floors. Gorillas are mostly ground-dwelling compared to other primates because of their huge body mass that would be a challenge for any difficult climbs. Though, the study witnessed a low ground-dwelling activity, the night-sleep period was on the ground.

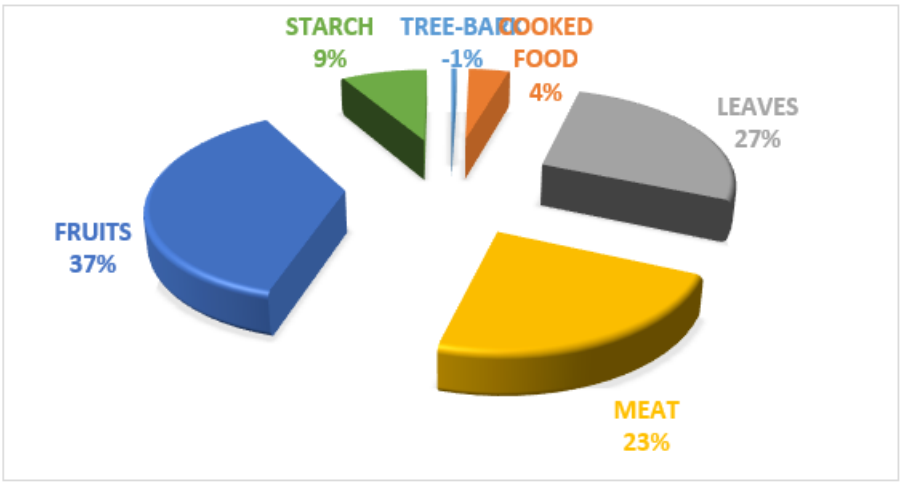


Fig6.*Food type*

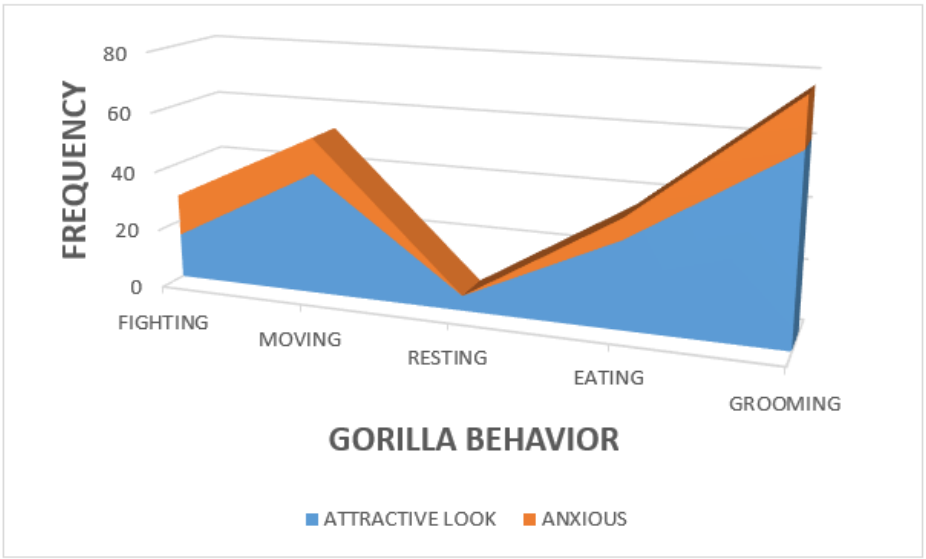


Fig7.*Gorilla behavior and their reaction to tourists*

Additionally, the animal behavior recorded a significance, X^2 = 11.658 df=4 P=0.02on the animal reaction to zoo tourists (fig.7). Touristic visitation in zoos is the principal source of income to enhance zoo management, reasons why countries rich in zoo management facilities attract more tourists, hence, more revenue is generated. Notwithstanding, zoo management should not compromise tourist influx on the welfare of animal activity, since huge human population is known to affect activity budget of some wildlife, such as gorillas. During tourist visits, the physical appearance of gorillas witnessed calm 69%, antagonistic aggressive look 27%, and exhaustion 4% respectively (fig.8). It should be noted that frequent screams or roars made by captive gorillas should not be taken lightly because it is a clear anger indication, especially during noisy touristic visitation that gorillas sometimes misunderstand for attacks, provoking them to switch to counter aggressive behaviors.

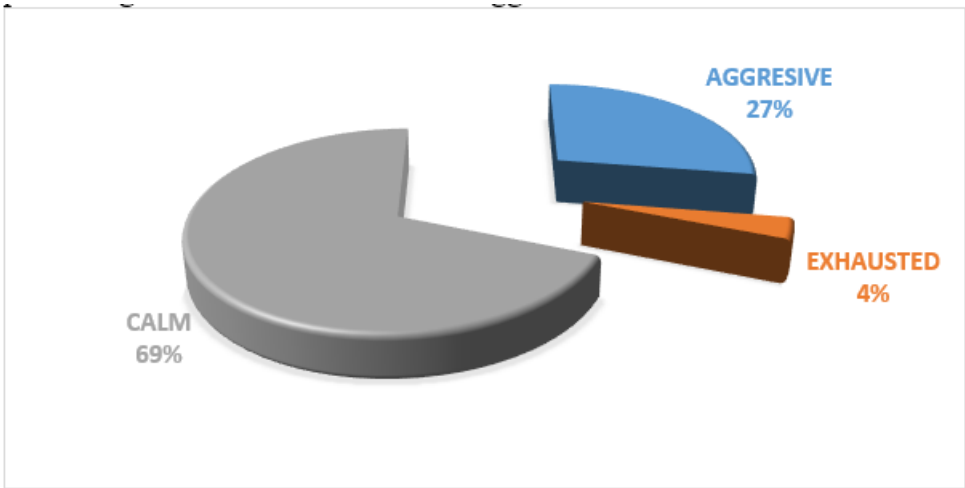


Fig8.*The physical appearance of the gorillas*

4. DISCUSSION

Fully understanding a species' behavioral repertoire can greatly improve the lives of animals in captivity. Within the last 40 years, zoos have embraced their roles as institutions of conservation, education, and research. Caring for exotic and endangered species encompasses several objectives, among which are the promotion of species-typical behaviors and preparing for reintroduction to natural habitats where possible (Forthman and Ogden, 1992). Species-typical behaviors may be absent or altered in captive animals. Captivity in and of itself is conducive for the development of abnormal behaviors, due to an animal's lack of control over its own daily schedule (particularly with feeding), space restrictions, and visitor proximity (Hosey, 2005).

Zoo personnel work diligently to create naturalistic habitats and provide their animals with environmental enrichment in order to encourage healthy behaviors within their collections, which are needed for successful reproduction and possible reintroduction to the wild. In order for these to occur successfully, the full range of an animal's behaviors must be shown while in captivity (Forthman and Ogden, 1992; Rooney and Sleeman, 1998). With regard to habitat design, the physical features of captive enclosures must have a positive effect on several aspects of an animal's behavior. Habitats are created to mirror that species' habitat in the wild and to include plenty of biologically relevant features. Environmental enrichment is a key component; it can be used to encourage more natural feeding behaviors, social interaction, cognitive activity, etc. The implementation of proper enrichment for a given species can vastly improve its quality of life in captivity. Zoo keepers and enclosure designers must also eliminate harmful elements from the animals' areas, like disease-carrying pests and interference from the public (Forthman and Ogden, 1992; Rooney and Sleeman, 1998). A captive environment alters the natural behaviour of animals (Fischer and Romero 2019; Sherwen andHemsworth 2019; Sueur and Pelé 2019). Studies by Bonnie et al. (2016) and Ogden et al. (1990) suggest abnormal behaviours are more common in captive gorillas, which could impact the conventional social associations expected in western lowland gorillas. In addition, captive environments remove the spatial freedom experienced in the wild, meaning social proximities may not reflect those of wild counterparts and may 'force' social proximity in some instances.

Beyond habitat design and environmental enrichment, several other factors can contribute to the overall well-being of captive animals. Healthy, highenergy diets and frequent feedings keep animals functioning at an optimal level. Giving animals the ability to move freely about their enclosure or shifting them to new areas of the habitat on a regular basis is both physically and mentally stimulating. Similarly, organized training sessions with appropriate positive reinforcement meet the same goals. Training by operant conditioning strengthens important husbandry behaviors that are used to improve daily interaction with keepers and for veterinary examinations. Reinforcing learned behaviors on a daily basis serves to improve physical health as well as psychological welfare (Forthman and Ogden, 1992).

Gorillas are predominately herbivorous, consuming mostly leafy green vegetation and fruit, which are abundant in central Africa (Harcourt and Stewart, 2007; Rothman et al., 2006). Western lowland gorillas consumes herbaceous vegetation from both terrestrial and aquatic areas, the latter being acquired during gorillas' occasional swamp-wading endeavors (Doran and McNeilage, 1998). Fruit comprises about 60 percent of a gorilla's diet, but the amount and varieties of fruits they consume vary with seasonal availability (Rothman et al., 2006). However, western lowland gorillas incorporate far more fruit into their diets than do the other subspecies of gorillas, especially mountain gorillas (Doran and McNeilage, 1998). Fruit provides a marginal amount of proteins and fat, both of which are hard to come by in herbaceous vegetation. When fruit is scarce, gorillas often resort to consuming bark, decomposing leaves, and insects in order to obtain their daily allotment of nutrients and calories (Rothman et al., 2006).

In a normal western lowland gorilla diet, nutrients are sparse. Gorillas must eat constantly in order to supply their bodies with adequate energy. These animals have a large colon and cecum, which are adept at extracting nutrients from typically nutrient-poor food sources. Because western lowland gorillas are large, they can cope with eating a great amount of low-nutrient foods (Harcourt and Stewart, 2007). Plentiful intestinal microbes are capable of breaking down cellulose for further nutrient extraction (Bittar et al., 2014). To accommodate the large percentage of nutrient-poor foods they consume, gorillas normally conserve their energy through rest. On a typical day, gorillas will rest after their morning foraging, doing so for about 33 percent of their day. They also sleep for 13 hours a night, similar to the rest patterns of the other great apes (Harcourt and Stewart, 2007). Western lowland gorilla locomotor behavior is shared with all African apes. Gorillas move predominantly by knuckle-walking, which is a quadrupedal mode of locomotion where the fingers are slightly curved in order for the animal's weight to be distributed on the ground through the knuckles. Gorillas can move bipedally for short distances in cases of defense, display, or when carrying food (Richmond et al., 2001).

Western lowland gorillas have a high degree of sexual dimorphism, with fully mature adult males (called silverbacks due to the appearance of silver hair as a result of changing testosterone levels) being about twice the size of adult females. Silverbacks can reach between 1.5-2 meters in height and weigh 130-270 kilograms. Females, on the other hand, usually only reach about 1.5 meters in height and weigh half as much as males. Even so, both genders of gorillas are the largest of the great apes, which is an asset when it comes to defending themselves and their offspring (Harcourt and Stewart, 2007).

Captive groups of western lowland gorillas do not have an opportunity to freely intermingle at any time or move to a secondary group. The inability of gorillas to move between family groups, the smaller shared space, and their constant visibility to visitors might be cause for captive western lowland gorillas to exhibit an increased frequency of agonistic behaviors in their interactions with one another. Making life comfortable for gorillas can decrease agonism and lead to increased reproductive opportunities for the animals in a group (Hosey, 2005). Zoos hold the responsibility of designing gorilla family groups. Thanks to the substantial work by scientists, there is a much greater understanding of gorilla behavior and ecology. By creating groups with the appropriate gender ratios, there is an increased likelihood of harmonious interactions among group members (Harcourt and Stewart, 2007; Stoinski et al., 2001). In some cases, there is the potential for unrelated males and females to end up in the same secondary group after being raised together as infants. It is believed that

the high degree of familiarity will result in an unsuccessful breeding relationship, so zoo managers must act as "dispersal agents" for captive gorillas in order to foster successful breeding (Watts, 1990; Stoinski et al., 2001).

5. CONCLUSION

The captive environment of wildlife is a conservation strategy used by many countries to conserve wildlife population for the purpose of income and education. However, most zoos, especially in sub Saharan Africa have included the component wildlife seizures from poachers for their protection. Limbe Wildlife Centre homes many species of wildlife, including gorillas, with a strategy of managing their population for future possible re-introduction into the wild. The research preparation for gorilla population possible translocation to the wild is a great strategy, however, the animal welfare in the wild after a long duration in the zoo environment is the greatest task in conversation world. A follow-up to confirm the animal's proper re-adaptation in the wild needswildlife experts and a huge budget. Hiring of experts to enable the zoo management translocate the animals successfully back to the wild is the objective Limbe Wildlife Center.Management enhancement are only justified by successful re-introduction programs carried out on the conservation of wildlife species in the zoo. The training of wildlife experts in the Department of Forestry and Wildlife in the University of Buea is a huge boost to wildlife conservation achievement in the country, together with the flexibility of Ministry of Forestry and Wildlife towards workers in-service training and incorporation of academician into wildlife population management programs, a green light to future wildlife population increase within and around protected areas.

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