

**CAPTIVE BREEDING OF STUMP TAILED MACAQUE
AT AIZAWL ZOOLOGICAL PARK
WITH REFERENCE TO
THE TYPE OF HABITAT IN THE ENCLOSURE**



**SUBMITTED BY
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**Submitted to: Central Zoo Authority
Ministry of Environment and Forest
Government of India**

Abstract:

I studied Breeding behavior of Stump Tailed Macaque (*Macaca speciosa*) in captivity with reference to the type of habitat in the enclosure at Aizawl Zoological Park, Mizoram India. Twelve number of individual live there. I studied the mating behavior, season, mating frequency, copulatory attempts, time spent in copulation, time interval between copulation, gestation period, birth interval, infant care, physical and physiological parameters of infant and adult, feed preference, adaptation and effects of vegetation during 2007 – 2008. I observed that the most breeding season is between September and February but less or no mating also found on other times of the year. Mating was intensive in the morning session (0900 – 1200 hrs.); and 80% of mating occur during this period. The average gestation length was 178 days. November - January was the most favorable month for breeding and duration of mating was maximum in December. Average time per mounting is 5 – 10 minutes and inter birth interval was 24 months

Key words: birth interval, breeding season, gestation length, mating behavior, reproduction



DETAIL REPORT

- 1. Time Period** : 1 Year
- 2. Name of the project** : Detailed study on captive breeding behavior of Stump Tailed Macaque at Zoological Park, Aizawl with reference to type of habitat in the Enclosure.
- 3. Name of the organization** : Aizawl Zoological Park. Mizoram
- 4. Research Project Leader & Principal Investigator** : Dr. Vanlalhruaia Pachuau.
Veterinary Assistant Surgeon.
Aizawl Zoological Park.
- 5. Co-Investigator** : Dr. Lalnuntluangi Hmar
- 6. Sanction order and date** : F.No.9-2/2006-CZA (M)
Dt.14.7.2006.
- 7. Total approved project cost** : 2 lakhs
- 8. Date of M.O.U signed** : Dt. 31.7.2006.
- 9. Year wise fund released** : Rs. 1 lakhs (2007)
Rs. 0.6 lakhs (2008)

- 10. Date of receiving the fund** : Dt. 27.10.06
DD.No.611270. Dt.16.10.06
- 11. Amount of received for 1st. Installment:** Rs. 1.00 lakh
- 12. Amount received in 2nd. Installment** Rs. 0.6 lakhs
- 13. Total fund utilized** Rs. 1.6 lakhs
- 14. Fund Return** Nil
- 15. Date of Commencement of the Project** : Dt. 30.07.2006
- 16. Research and technical achievement**



INTRODUCTION AND BACKGROUND HISTORY

Aizawl Mini Zoo originated from the private collection of a Deputy Commissioner A.C. Ray on 17.1.1970 at his official residence. The collection was shifted to a Children Park on 21.4.1972 at the centre of Aizawl City near Raj Niwas (now the Children Park become City Park) The animals were then transferred to a new site at Bethlehem Veng below Aizawl City with an area of 198 Hectare of uneven to very steep configuration, crisscrossed by nullah. The Zoo was officially inaugurated on 1.10.1977 by the then Lt. Governor S.K. Chibber. The actual area covered by the Zoo was 10 Hectare.

The Zoo originally exhibited 67 mammals representing 10 species including 10 numbers of Stump Tailed Macaques, 34 birds representing 9 species and one species of reptile.

All most all animals are exhibited in steel cage or in a congested confined area except Barking deer and Sambar deer. Particularly primate enclosure are congested with an area of 6x10 ft comprising more than 10 primates of adult and infant. Primates are found normal in their feeding, drinking and grooming. Physiological and Biological characters are seems to be normal but their reproductive behavior were not success for about a decades or more. Female primate do not show any sign of estrus or heat symptoms, dominant male sometimes mount upon the female with average duration of 1 – 5 minute, but no conception in females is notice for such a prolong period.

Similarly due to the undesirable condition of enclosure and atmosphere in the Zoo, Primate population can not be increase from their biological reproduction unless there is donation or new arrival of animals from outsides. Other animals and birds are also not increase in their numbers among their population during 25 years with the exception in Sambar and barking deer.

Considering such various reasons the proposal for relocation to some other convenient place was submitted to Chief Wildlife Warden by the Member Secretary, Central Zoo Authority (Shri. SC. Sharma) on 10.12.1996.

Efforts for finding of suitable site had been going for sometimes and finally one location (15-17 kms. from Aizawl to Lengpui Airport) with an area of 65 Hectare had been selected by Member Secretary, Central Zoo Authority (the then PR Sinha) and Dr. B.M. Arora,

Member Central Zoo Authority. Final Government approval to shifting of Zoo was obtained on 12.06.2000 vide Govt. letter no. B-12015/2/92-FST.Dt.12.06.2000.

The new site of Zoological Park is located at 23.47°41 – 23.47°23 latitude N. and 92.40°00 – 92.40° 05 Longitude E. It was recognized by C.Z.A. on 10/9/06 Vide letter no. F No. 19 – 23 / 92 – C.Z.A. (191) (M) and inaugurated on 24.11.2006 by Zoramthanga Hon'ble Chief Minister of Mizoram. The Zoo has better vegetation in comparison to old zoo. Natural trees, bamboo and other vegetation are kept undisturbed and varieties of trees are also planted to improve the habitat. The Zoo has a total length of 2.9 km. complete boundary brick wall fencing. Electricity is tapped from 11.00 KV line and one 25 KVA transformer is installed. A big dam with a capacity of 18.00 Lac litter had been constructed nearby a perennial stream. The water store in the dam is lifted to a Power Pump to the reservoir of 65,000 liters capacity at the top of the hill above the Zoo. This water is distributed to different enclosure section.

AIMS AND OBJECTIVES

The research project has the following aims and objectives which would be suitable for future management of animals at the Aizawl Zoological Park. The aims and objectives has been laid out base on the requirement of technical information at the local level since there were no earlier study and record for any species of animals and birds at Aizawl Zoological Park for better zoo management. The objectives are:

1. To know the exact breeding seasons and breeding characters
2. To know the gestation period of the animal
3. To know physiological and physical parameters of new born baby.
4. Successful breeding of Stump Tailed Macaque in Zoo
5. To help in conservation
6. To increase the population of endanger species
7. To help in scientific management of Zoo animals.

Pilot Study:

A preliminary study was conducted prior to research work. Initially an attempt was made to conduct the research throughout the day and night, but it has been found that the animals are diurnal and no mating or breeding character are noticed during the night and decided that the study work is to be conducted only during the day. Vegetation in the enclosure, furniture provided as well as the feeds locally available is studied carefully. Population size such as Numbers of animals in the enclosure, numbers of adult and infants, male and female ratio, whether or not the breeding taking place in the past are also considered during this pilot study. Desirable animals to be selected for further breeding as well as the sites are

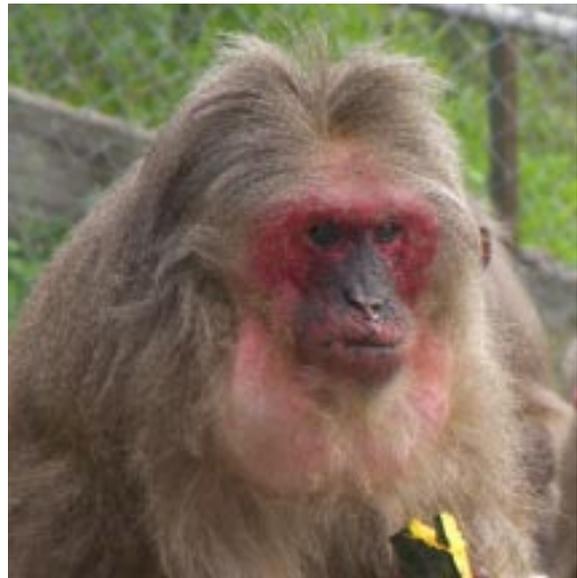
selected and prepare for observation.

It has been found that the animals are wake up in the morning at 5:00 – 6:00 in the morning and their behavior are mostly active during the day time in between 8:00 am – 4:00 pm in general and more active at 10:00 am – 1:00 pm in particular. It has been expected that the objectives of the project can also be achieved from the preliminary study.

LITERATURE REVIEW:

TAXONOMY

Sub order	:	Anthropoidea
Infra order	:	Catarrhini
Super family	:	Cercopithecoidea
Family	:	Cercopithecidae
Sub family	:	Cercopithecinae
Genus	:	Macaca
Species	:	arctoides



Stump Tailed Macaque the name *Macaca arctoides* was changed from *Macaca speciosa* in 1976 is also name as bear Macaque. The monkey under this family have close nostril together, cheek pouches, with a dental formula: I - 2/2, C – 1/1, Pm – 2/2, M – 3/3. The thumb is opposable and the tail is not prehensile. There are ischial callosity on the buttocks and their gait is quadrupedal.

Distinguishing Characters:

Stump Tailed Macaques are dark brown, with a short and nearly hairless tail. The face is also hairless and mottled with varying amount of black and red skin which dark brown or nearly black as they age and are exposed to sunlight. The forehead is bald and more in old age of male, buttock and genitalia are reddish and the tail is stubby where as other parts of the body is cover with thick, long, dark brown coat. The neonates are creamy white at birth and gradually turn to dark brown at age (Fa 1969, Row 1996, Groves 2001). Males are larger than the females measuring up to 12.5 Kg and female average weight up to 10 Kg. The average height of male is measure as 20.4 – 25.6 inches and the female is 19.1 – 23.0 inches. This sexual dimorphism extends to more than just body size; Male Stump Tailed Macaque have elongated canine teeth compare to females, which are important for establishing daminance³ within social groups. All macaques including Stump Tailed, have pouches in their cheeks to store food for short period of time (Rowe 1996) They travel



quadrupedally and usually on the ground for they are not very agile in trees(Rowe 1996, Srivastava 1990). They are not known to swim, as do other species of macaque (Fooden 1990)

HABITAT:

Stump Tailed macaque are generally found in subtropical and tropical broadleaf evergreen forest (Fa 1989). They are found in different habitat and different elevation, they lives in dense evergreen rain forest below 1500 meter, depending on the amount of rainfall in the area. They depend on rain forest for food and shelter and are not found in dry forest except where they range in the Himalayan region of India (Fooden et al.1985; Gupta 2002). They do not spent much time in secondary forests and only do so if they are bordering primary tropical forest (Fooden 1990, Srivastava 1999)

ECOLOGY:

Starting the day at dawn, Stump Tailed Macaques spend the early morning, until midday, traveling and feeding. They are Frugivores - omnivores and a significant part of their diet is devoted to fruits. They also eat seeds, flowers, leaves, roots, freshwater crabs, frogs, birds, bird eggs, and insects (Fooden 1990, Rowe 1996, Srivastava 1999). They also raid crops preferring corns and other cultivated fruits. During the middle of the day, the group stop traveling and rest in the shade, spending time on social activities such as grooming while juveniles and adolescents play (Fooden et al.1985) In the late afternoon foraging begins again as they travel to their sleeping sites, usually large tree or cliffs. The Stump Tailed Macaque can traveled 2 – 3 Km in a day but they do not travel far during rainy seasons when food is abundant. Their home range is thought to be several square Kilometers.

METHODOLOGY

The Macaque kept in enclosure as well as in the Breeding Cell and Maternity Cells are closely observed on everyday. Principal investigator (Project leader) and other assistants start their daily work by feeding the animals on 7:00 a.m. in the morning. Fecal materials, feed residue and other litter are cleaned after 2 (two) hours of feeding. The duty orientation of the attendant is on rotational basis depending upon condition of animals. Feeding trough, water trough, bucket, basin, mugs, furniture and enclosure were clean and washed everyday and disinfect monthly with safe disinfectants.

From 10:00 O'clock in the morning, animals were observed at the station as per the instruction made by Project leader till 6:00 pm in the evening. Since the beginning of the research work, animals were monitor very carefully throughout the day, It is also found that the animals does not have any activity relating to the breeding or mating at night and most of the mating or breeding activity occurs during day time.

Interested persons from locality, Professors from Veterinary College, Zoology Department from Mizoram University, Departmental officials and important visitors from outsiders are also consulted for further information. Available Books and journals of the relevant matter also collected for references.

During the period of observation, three pairs of stump Tailed Macaque are solated in a separate cell at the ratio of 1:1 and the rest of female are headed by one male. Various characters of Stump Tailed Macaque are deeply studied in each cells of animals.

SOCIAL BEHAVIOUR AND ORGANIZATION

Stump Tailed Macaques lives in large, groups of multi-male/multi-female from five to 60 individuals (Fooden 1990; Rowe 1996; Srivastava 1999) Females remain in the groups while males leave the group before sexual maturity and sometimes immigrate into a new group to breed others (Fooden 19990). Stump-tailed macaques exhibit hierarchies enforced by both contact (slapping, hitting and biting) and non-contact (threatening displays) aggression. Aggressive behavior among Stump-Tailed Macaques is not as physically dangerous as it is



exhibit by other macaque species, (Butovskaya 1993). Adult males, after immigrating into a new group, also form a strict dominance hierarchy through fighting. After a fight, Stump-Tailed Macaques have ritualized reconciliation behaviors: the lower subordinate presents his rump to the dominant individual acknowledges the gesture. The dominant male may embrace and kiss the subordinate and pick the buttock region, which will respond with “teeth chattering” and “lip smacking” both signs of submission. Finally, the subordinate offers a hand to the dominant individual who will softly mouth or “mock bite” the hand. After this interaction, the bond is purportedly restored and the dominants hierarchy is reinforced (de Wall 1993; Srivastava 1999). Males are dominant over the whole females, and the alpha male guides the groups travel all the way and he and several males who rank directly below him in the hierarchy guard the group against predators while the group forages in the wild (Fooden et al.1985; Srivastava 1999). Sometimes adult males protect infants, juveniles and the lower member if they are in potential danger and interfere in female-female interactions (Srivastava 1999).

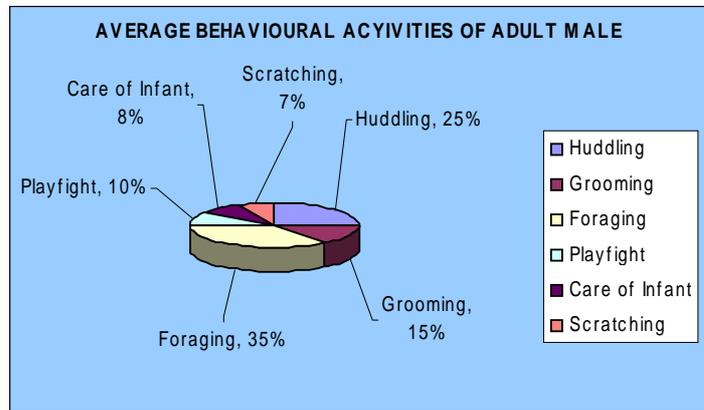


Fig 1.1

Adult male have various behavioral activities whether he is dominant or sub dominant among the group. In captivity, the male spent maximum time for foraging on the ground to search insects, vegetables, fruits and other food items. In the meant time, the male macaque joints the huddling of the members or to rest in a shade in the hot climate. Huddling is generally seen under the tree or shade area of the enclosure, male occasionally spent time for grooming, scratching himself, showing and aggressive behavior to the lower ranking of male also sometimes take care of the newly born infants as shown in Fig 1.1

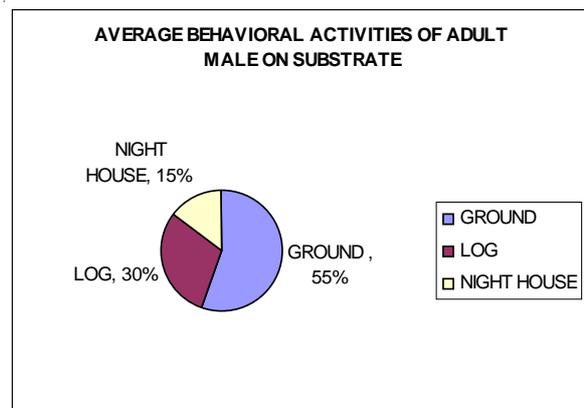


Fig 1.2

Stump Tailed Macaque is not very agile in tree as it is on the ground. They are arboreal and terrestrial animals, but their terrestrial behavior is more prominent in comparison to arboreal behavior. They spent more than half of their time on ground for grooming, foraging and huddling. Occasionally they climb on trees, log or furniture provided. See Figure 1.2

Social grooming is a form of an interaction that promotes affiliation and group cohesion. These grooming interruptions are very common during early morning and late afternoon. Stump Tailed Macaque occasionally exhibit grooming which may last for a few seconds to more than an hour. Adult female groom and adult males reciprocate but it is a



female biased activity. In a captive study, of all social behavior in involves touching and huddling. Agonistic behavior toward mating pair was mostly directed by adult females and unweaned juveniles of the mated female. The tail position indicates and individual intentions: tail down means submission or fright; tail curled up indicates excitement; tail straight up is an assertion of dominance. The play teeth-chattering face is a greeting signal. Redirected aggression is also commonly seen, i.e. when attacked by a high-ranking individual, it will attack a nearby subordinate.

MATING AND BEHAVIOUR

Dominant males copulate with high-ranking females throughout their estrus cycles. The process of copulation observed at Aizawl Zoological Park lasts 5 – 10 minutes (Srivastava 10-20), after which partners remains attached and are often harassed by other members of the group in captive conditions almost all the mating interactions were harassed. A crescent shaped vaginal plug is formed by semen. The male’s penis fits lock and key with the female’s specialized reproductive tract is seen in some group but such locking system are not seen at Aizawl Zoological Park throughout the study period of 1 year. Sometimes dominant male also mount frequently upon the female without ejaculation. It is also frequently seen that the dominant male eat the semen from the tip of the penis and from the vaginal region after his dismount, at the same time the female also take it out some of the semen from her vaginal region and consumed it all.

During the study period at Aizawl Zoological Park, Mizoram, maximum copulation (55%) seen at the early part of the fore noon and less frequent on the first half of evening. Little or no copulation observed in early morning and late evening. See Figure 1.3

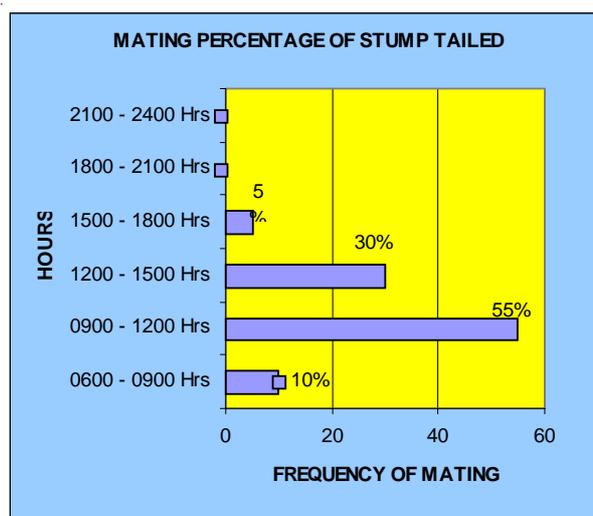


Fig 1.3

Stump Tailed Macaque are not a seasonal breeder in captivity, mating seen almost throughout the year in captive condition. As per our observation, the most favorable breeding season is start from October to December. During this study period, we have made the time scale in four parts and 55.52% of the total copulation is observed during October to December. Mating observed are less during July to September and January to March where as mating during April to May is negligible or no mating since the female do not show any heat signs during this period.(Fig : 1.4)

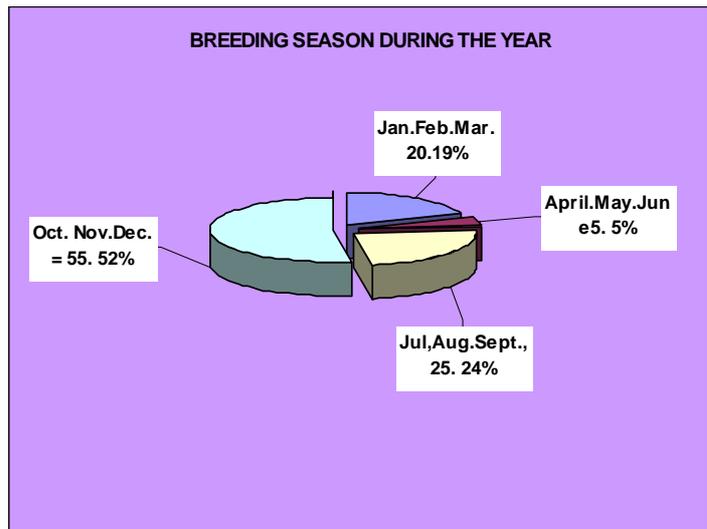


Fig 1.4

REPRODUCTIVE PERFORMANCE

Stump Tailed Macaque have low reproductive rates compared to other macaque species. Female reach sexual maturity around 4 year of age and have an ovarian cycles lasting 30 days. Most mating occurs in October to December in the wild and is not seasonal in captivity (Brereton 1994). Females begin to produce offspring between four and five years of age and will produced until about 17 years of age (Fooden 1990). Males reach sexual maturity around four years of age as well, but do not reach adult size until around six years.

Frequency of mating correlates with dominance rank among Stump Tailed Macaques. The highest ranking males monopolize receptive females while the highest ranking



females are also the most likely to do the most mating (Brereton 1994). Lower ranking male stump-tailed macaques use alternative methods to gain mating opportunities. One way they do this is by lagging behind with a reproductively active female as the group travels. When the dominant males are out of sight, the lower ranking male mates with the female and the couple then moves to rejoin the group (Brereton 1992). Both male and females solicit mating, females by presenting their rumps to males and maintaining eye contact over one of their shoulders, and males by approaching a female,

sitting next to her, and giving a “teeth chattering with grimace” display (Brereton 1994). During copulation, other members of the group harass the pair (Srivastava 1999). Gestation lasts 177 days and females give birth about every two years in the wild (Fooden 1990; Srivastava 1999).

After gestation which averages 178 days, females give birth to a single offspring. Females breed every two years. Mothers feed their infants for six months to one year and infants develop complete independence at the age of nine to 18 months. Females are sexually mature by four years and males by six years. They can live up to 30 years in captive conditions and the present oldest male is 28 yrs at Aizawl Zoological Park. During our study period, we have observed that a single male can copulate 10 times in a day and 20 – 40 times during the estrus period. The estrus cycles last for 30 days the duration of heat last for about 5 -10 days. The feed intake during the heat period is little less in comparison to other days. Dominant male generally copulate the female during the heat period but the lower ranking of male also copulate the other female while the dominant male is doing. The time interval between inter mating different depending upon the libido of male, an average time interval recorded is between 20 – 50 minutes.

Labor and parturition are very difficult to observe as it is occur only during the late night. The pregnant mother do not show any signs of labor, uneasiness, pain, vaginal discharge before five hours of delivery. Closed observation and monitoring can easily disturb the female during labor, providing light for better observation and making noise also can delay the parturition and may result dystokia. It has been found that other member do not assist the pregnant female during labor. The period observed last for 1 hour from 0020 hrs and the baby cling to the mother soon after birth. During delivery the mother is in different position either by sitting, moving around at different places. As soon as the baby born, the mother holds the baby on her abdomen with an extreme care and started nursing. Other member also very fond of the new born and they try to touch and hold on their arm. But the mother never allowed to hand over her infant to the other and never released from her body. In the meant time other Stump Tailed Macaque even the dominant and aggressive male never hurt the new born baby.

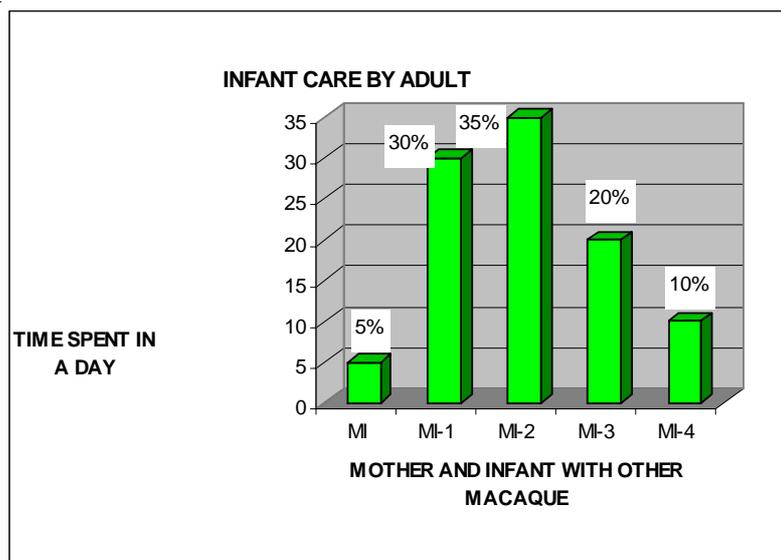


Fig: 1.5 (MI = Mother and infant, MI-1 =Mother and infant with other 1 member, MI-2 = Mother and infant with 2 other member, So and so.)

Macaque mothers are the primary caregivers for their offspring, though all of the females in the group direct attention to infants and will approach, play with, carry, groom and protect them, especially if they are born to a high-ranking mother. It has been observed that Mother and infant alone is rarely seen sitting in remote area. Most of the time the mother and infant are guarded or accompanied by one or two other members. It is also frequently seen that mother and infant are accompanied by three or four members. Maximum of four members is seen during the study period but less frequent as 4% as indicated in the figure 1.5. The new born baby and mother spent maximum time with 2 other members (35%), the other member accompanied the nursing mother act as a sentry to protect the young one from other animals. The accompanied members also sometimes try to play, kiss, hug the new born infant. By protecting a high-ranking female's infant, a lower-ranking female may expect rewards of tolerance and reduced aggression by the high-ranking female (Estrada & Estrada 1984). High-ranking adult males also direct some attention towards and give protection to infants within a group. This may be because higher-ranking males have more chances to mate with females and because there is increased likelihood that infants in the group are their offspring, males have some interest in protecting them from danger (Bauers & Hearn 1994). Stump-tailed macaques are considered permissive



mothers compared to other species, and early on they allow the infant to independently explore the surrounding environment (Maestriperi 1995). They may be this lenient because other group members are interested in infants but never treat them roughly or “kidnap” them as seen in other macaques (e.g, *M. nemestrina* and *M. fascicularis*) (Bauers & Hearn 1994). Stump-tailed macaque infants are dependent for the first nine months of life, after which they are weaned, and become increasingly independence until adolescence, at 18 months (Srivastava 1999).

ACTIVITIES OF INFANT

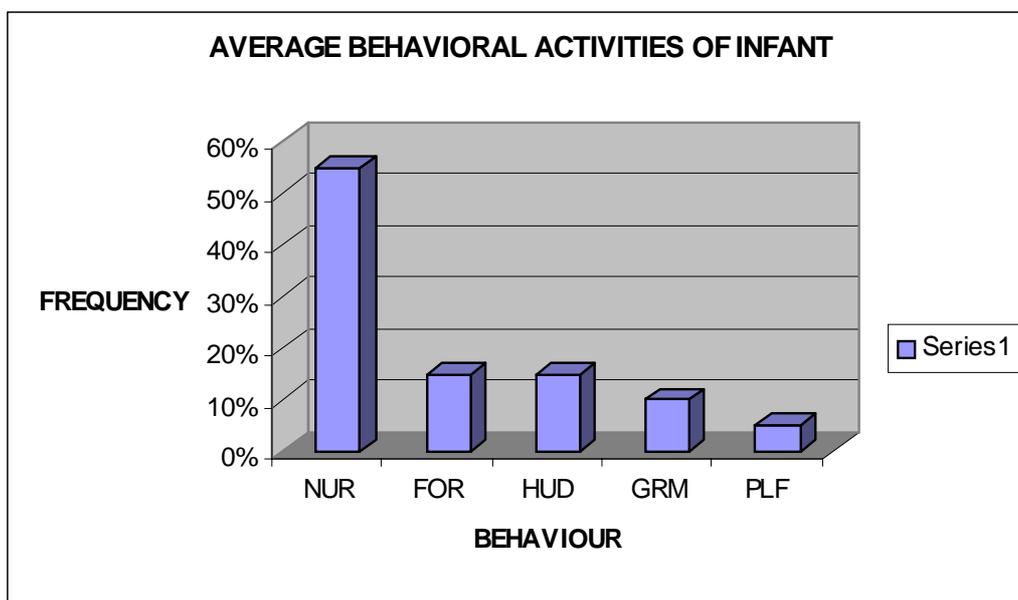


Figure: 1.6 NUR = Nursing, FOR = Foraging, HUD = Huddling, GRM = Grooming, PLF = Play Fight

During the first month of the baby born, the behavior of new born infant is thoroughly study continuously from the first day. The behavior of infant like; nursing, foraging, huddling, grooming and play fight are considered including the time requirement. It has been found that the infant spent about half of the day (50%) for nursing by clinging to the mother breast. The time spent for foraging on the ground, huddling with the other, grooming with mother and playing with the other young ones are comparatively less. (Figure 1.6)

The behavioral activity of new born baby on substrate is also considered during this observation. As the infant is newly born, it spent maximum time (60%) to the mother by clinging to her breast and suckling the mothers' milk. When the baby become older the baby

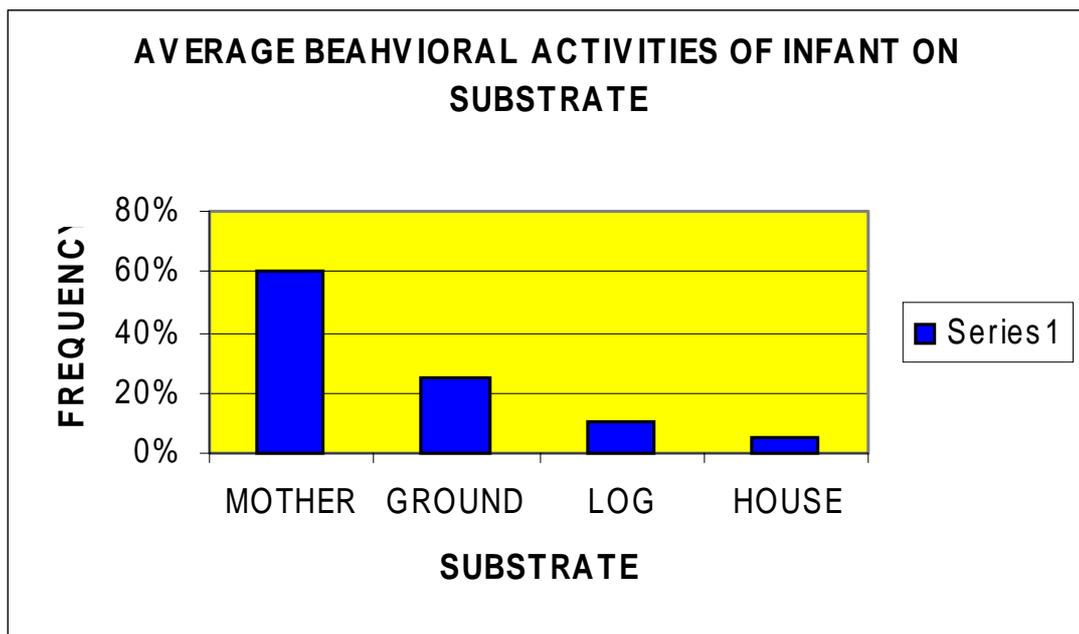


Fig 1.7

move little away from the mother and also spent little time on ground, log, tree or furniture provided and night house at 20%, 10%, and 5% respectively. (Figure: 1.7)

DEVELOPMENT STAGE AND GROWTH OF INFANT

The developmental stages and growth rate of Stump Tailed Macaque from the first day of birth to adult stage also study by considering the previous zoo records. The development and growth rate of Stump Tailed Macaque is very progressive in comparison to Rhesus Macaque and Assamese Macaque. The baby remains to the mother breast for 6 – 7 month, the baby sit on the night house is first seen on 15 days (0.5 month) and also seen the baby sitting on the ground is after 30 days (1 month). It is also observed that the baby start walking slowly on the ground by quadrupedally from 2 months onward and by 2.5 months the infants can move from one place to other of short distance. By 4 months, the colour of infants turns from white to dark brown. This dark brown colour first appears on the dorsal site of the whole body and the ventral site, face, throat, arms and legs are remain white which gradually darken by age.

At the age of 1 Yr. the face becomes reddish in colour regardless of sex, which is gradually reddish black by age and remain throughout the life time. When the baby becomes juvenile at the age of three years, a prominent pair of sexual gland is developed in female just below the vaginal opening. This Sexual gland is reddish in colour and resembles the testicles in consistency. A pair of sexual gland developed is almost the same size in all juvenile female which measure 2 x 3 cms. During the presence of this Sexual gland, the female never show any heat signs and remain for one to one and half year. By the age 4 years (48 months)

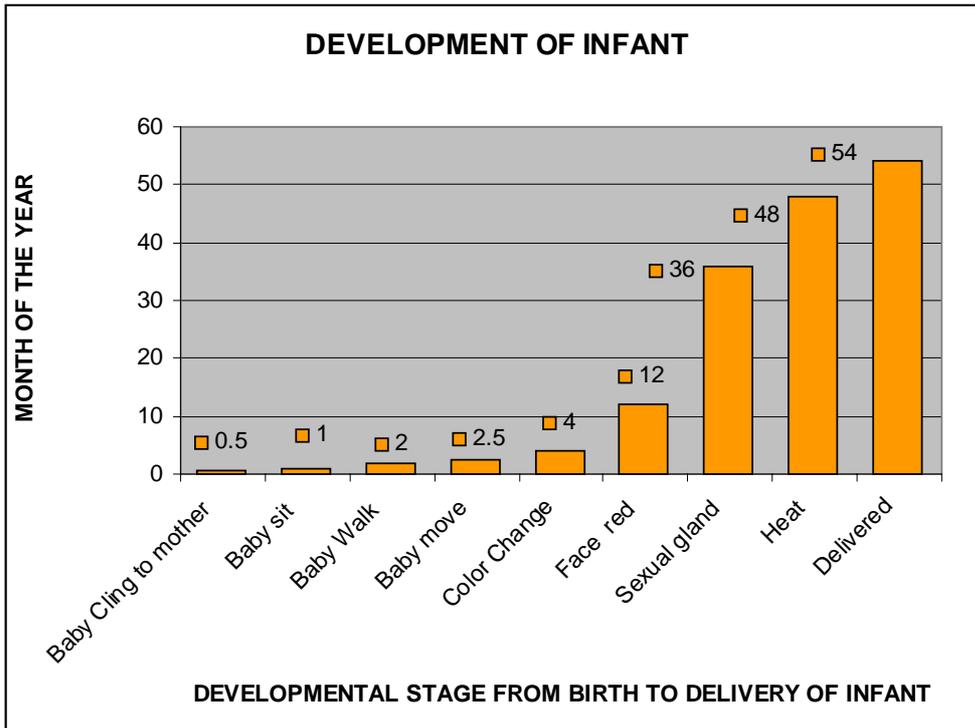


Fig 1.8

female become sexually mature, showing the estrus behavior and by the age of four and half to five years they can deliver the baby. (Figure 1.8)

BEHAVIOR OF JUVENILE

Behavior of Juvenile Stump Tailed Macaque is more or less the same with the adult male and female. In general the juvenile give more attention and will approach, play with, carry, groom and protect them, if the infant is born from a dominant female. In this case, juvenile Stump Tailed Macaque involved more in caring of young ones in comparison to older members. Moreover, the juvenile members play a very important role in protecting the infants against predator and other animals. They are the most agile group in all activities. Considering five behaviors like Huddling, grooming, foraging, play fight and relaxing, the juvenile spent 35% of their life for foraging on the ground, huddling 25%, grooming one another 20%, play fight with the other 15% and relaxing in shade is 10%.

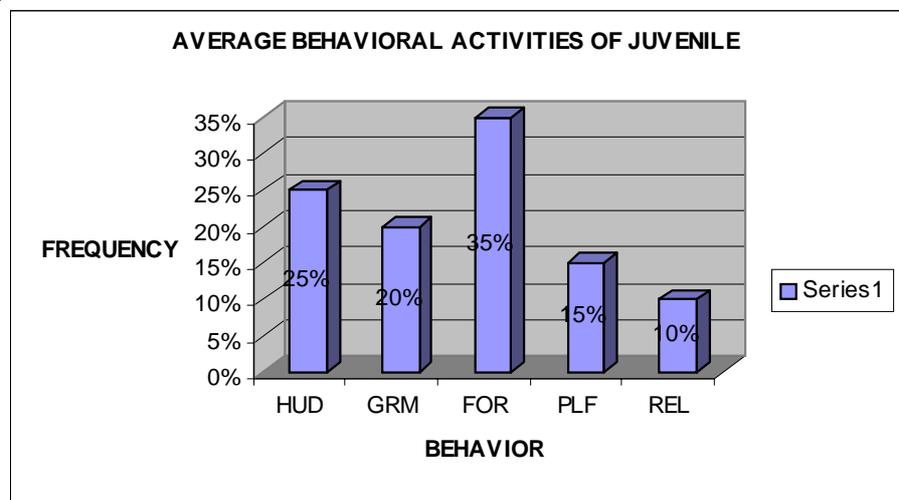


Fig 1.9

ACTIVITIES OF NURSING MOTHER

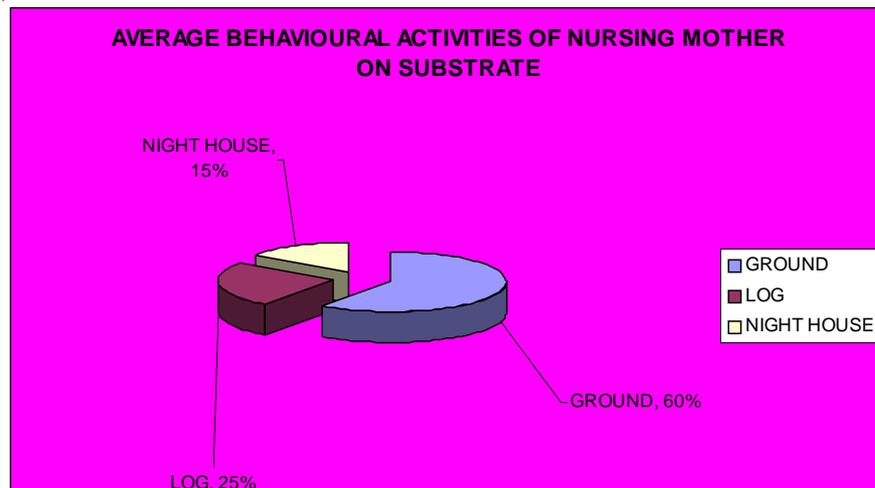


Fig 2.0

The over all activities of nursing mother is similar to that of adult male and juvenile, maximum time is spent for nursing on the ground. She spent less time for foraging, huddling, grooming and play fight. We observed that the mother also involve take part in grooming and huddling while nursing and do spent a little time at night house. (Fig 2.0 and 2.1)

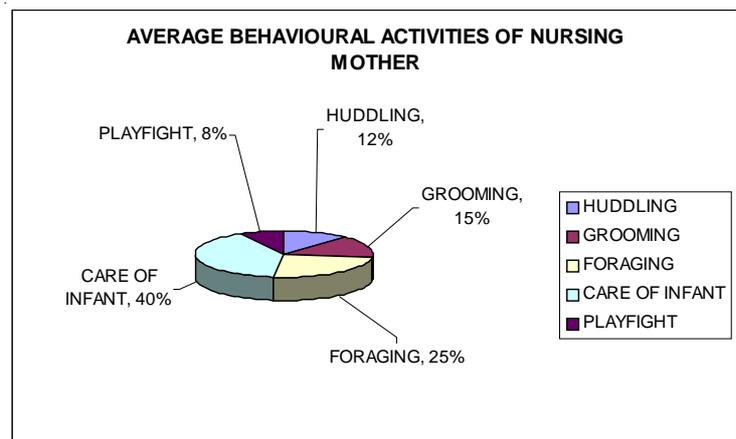


Fig 2.1

ANIMAL ENCLOSURE:

Stump Tailed Macaque enclosure is constructed at the center of Zoo with a perimeter of 145.00 meters having a unique feature. It is fenced with chain-linked mesh topped with galvanized iron sheet to prevent the escape of animals. Night house comprising of 2 units constructed at the upper portion of enclosures, bamboos and other vegetation are left undisturbed to preserve the natural habitat and to make enclosure ideal for animals. A variety of furniture such as hanging tyres and wooden, ropes, ladder, log and tree are provided for animal toys and to improve the habitat.

The enclosure is located in between Jackal and Leopard cat enclosure. Visitor

gallery is provided at the lower site of the enclosure so that the visitor would have a better view by looking the animal upward direction or above the body level and also to make physiological relationship between animal and visitors as well as for psychological impact on human being.

Preparation of site for breeding and Isolation unit for pregnant and nursery mother:

A separation cell for breeding of animals as well as for isolation of pregnant and nursing mother is constructed at one corner of the enclosure. The unit has 2 cells with an area of 30 Square feet each, covered with chain link wire mesh on all sides and the roof also covered with the same materials. Animal furniture such as ropes, wooden rack, tyres, ladders are provided, wooden and tyres were hanged for swing and climbing, shelter also provided inside the cell to protect against the extreme weather, rain, hot and sunny days. Each cell contains separate feeding cells and water trough with proper drainage system.

Hiding set for animal observation:

A hiding set for close observation of Stump Tailed Macaque is prepared at outside the enclosure. The hiding set adjacent to the enclosure is very helpful to observe the animal behavior and breeding characters without disturbing them. It is constructed with locally available materials. Furniture and stationery are kept ready at all times, Search light, umbrella, Rain Coat, Boots and essential items are also kept in the hiding set.

ROLE OF HABITAT IN THE ENCLOSURE

In wild, Stump Tailed Macaque (*Macaca arctoides*) are generally found in subtropical and tropical evergreen forest (Fa 1989). They are found in different vegetation and different altitude. They live in dense evergreen rain forest below 1500 meter, depending on the amount of rainfall in the area and the amount of food available and shelter. They are not found in dry forest except where they range in the Himalayan region of India (Fooden et al. 1985; Gupta 2002). In Mizoram, Stump Tailed Macaque are lives in tropical and subtropical forest. This forest has a natural vegetation of various evergreen trees, bamboo, shrubs, grasses, Cacti, water plants and other natural vegetation.

Since 1977, Mizoram State Mini housed 10 numbers of Stump Tailed Macaque in steel cage or in a congested confined area. The primate enclosure is congested particularly with an area of 6x10 ft comprising more than 10 adult Stump Tailed Macaque. There are no

vegetation and furniture, grass and vegetables are not provided. But feeding, drinking, huddling, play fight and grooming are normal. Physiological and Biological characters are seems to be normal but no successful reproduction are observed for a decades or more. Mounting occasionally seen but Female do not show any sign of estrus or heat symptoms, dominant male sometimes mount upon the female with average duration of 2 - 8 minute, but females never have conception for such a prolong period. Under this condition, primate numbers can not be increase from their biological reproduction unless there is donation or new arrival from outsides.

When the Macaque are transfer to New Zoo sites, they were house on the ground with fencing of chain link wire mess and full of natural vegetation such as bamboo, grass, climbers and few evergreen trees. Stump Tailed Macaque enjoy such environment and their body conformation also improving as they eat more variety of feed items but no new birth are seen as soon as they were introduced to such environment. It has been found that the breeding characters are seen only when the animals have adaptation and new birth are found gradually on the subsequent years.

Unfortunately, bamboo flowering occurs covering the whole state of Mizoram since 2006. Bamboo flowering is occur at fifty years interval effecting all the natural bamboo and had been vanished from the root levels resulting destruction of natural vegetation and habitat. Because of the bamboo flowering, the natural vegetation also vanished, enclosure has less shade, poor habitat and the physiology of Stump Tailed Macaque also little effected. An attempt is being made to restore the vegetation, more numbers of fruit bearing trees are planted, wooden furniture, ropes, stair, hanging tyres, shelter and water trough are provided to the enclosure and such provision are found very effective and helpful to increase biological reproduction.

COMMUNICATION

Communication among Stump-Tiled Macaque is mainly in the form of vocal or gestural signals. Gestures or postures are frequently seen used to reinforce the dominance hierarchy and reconcile after aggressive interactions. "Hindquarter presentation" is the most common gesture seen among adult Stump Tailed Macaques and is displayed by subordinates of lower dominant to appease dominants. Other submissive signals include "bared-teeth," "lip smack," "teeth-chatter," and "present arm," in which one arm is put directly in front of the face of the dominant individual to be bitten (Maestriperi 1996).

Vocal communication is also important among Stump Tailed Macaques. The most common vocalization is the "coo" heard in a variety of contexts, but especially relevant as group members maintain contact with each other while foraging and when approaching one another to initiate friendly interactions such as grooming or huddling (Rowe 1996). "Basic

grunts” are another ubiquitous signal among stump-tailed macaques; they are commonly heard between animals who are greeting one another, after aggressive interactions and when one animal is interested in another (Bauers 1989). Infants use “thrilled-whistles” as a signal of distress to their mothers when they are out of visual contact with them or if they need to be retrieved because they cannot descend a structure that they have climbed (Bauers 1989; Maestriperieri 1995).

PHYSICAL AND PHYSIOLOGICAL PARAMETERS

We have study and measure the physical and physiological parameter of adult male, female and new born baby. During the period of one year observation, five females gave birth and all of them are at night, one born in twin and the rest are in single. The physical parameters of new born are more or less the same either of the sex. But it is difficult to record the exact parameter of new born because of the hyper tension and excitement. Physical and physiological parameter of Sire and Dam also measured as follows:

New born (Single born)

1.	Respiration	-	55/min
2.	Heart beat	-	160/min
3.	Rectal Temperature	-	37.7°c
4.	Weight	-	440 gram
5.	Arm length	-	16cms (Without hand) (6.4 inches)
6.	Ear length	-	1cm (0.4 inches)
7.	Tail length	-	2.0cm (0.8 inches)
8.	Length of hind leg	-	27cms (with foot) (10.8 inches)
9.	Length of hand	-	5.3cms (2.12 inches)
10.	Length of foot	-	8cms (3.2 inches)
11.	Length if body	-	17cms (6.8 inches)
12.	Head size	-	21cms (8.4 inches)
13.	Girth	-	21cms (8.4 inches)
14.	Hip	-	15cms (6 inches)
15.	Male genital organ	-	1.8cm (0.72 inches)
16.	Height	-	17cms (6.8 inches)

Dam

1.	Weight	-	10.5 kg
2.	Length	-	49cms (19.1 Inches / 490 mm)

3. Body - 43cms (16.8 inches / 430 mm)
4. Length from left finger
to right finger of fore arm - 80cms (34 inches)
5. Respiration - 40/min.
6. Heart beat - 90/min.
7. Girth - 37cms (4.8 inches)
8. Tail length - 5.5cm (2.2 inches)
9. Ear length - 1.5cm (0.6 inches)

SIRE

1. Weight - 11kgs
2. Length (including head) - 50cms (20 inches)
3. Body - 40cms (16 inches)
4. Pulse - 66/min.
5. Respiration - 39/min.
6. Girth - 38cms (15.2 inches)
7. Length from left finger tip
to right finger tip of arm - 85cms (32 inches)
8. Length from right finger tip
of right arm to right finger tip
of right legs - 98cms (39.2 inches)
9. Tail length - 6 cm (2.4 inches)
10. Ear length - 2 cm (0.8 inches)

New Born (Twin)

The new born twins are birth in the late night and it is the first and ever recorded twin born Stump Tailed Macaque in the history of Aizawl Zoological Park, Mizoram. It is not known whether the fetus is single or twin before delivery. On thorough examination of the new born, it is estimated that the baby is born early before an expected time of delivery. The new born are male and female, Female infant was die at the time of delivery where as the male infant was alive till 10 days. These twins are born after a shorter period of gestation with lighter body weight and smaller in size in comparison to normal single born. Normally Stump Tailed Macaque gave a single birth, the twin born is really amazing for us. As per my observation, the delivery of twin in primate is very rare case. Either any one is death before or soon after delivery and the survival of the other also very poor. In any case of twin delivery, the gestation period is shorter, the size and weight of infant also smaller and lighter. This is

appropriate with the statement from the personal contact with Thi Elke Schwierz, Animal keeper, Frankfurt Zoological Society, German and Nguyen Thi Hien, Project Officer, Vietnam Primate Research Centre, Vietnam

Physical and physiological parameters of twin:

New born Female:

Hearth Beat	:	100 / minute
Respiration	:	72 / minute
Body weight	:	300 Grams
Ear length	:	1 cm (0.4 inches)
Tail length	:	2.5 cm (1 inche)
Length of hind legs	:	14 cm (5.6 inches)
Length of foot	:	6 cm (2.4 inches)
Length of arm	:	13 cm (5.2 inches)
Length of hand	:	4.2 cm (1.68 inches)
Head size	:	17 cm (6.8 inches)
Girth	:	14 cm (5.6 inches)

New born Male:

Body Weight	:	290 gram
Ear length	:	1 cm (0.4 inch)
Tail length	:	3 cm (1.2 inch)
Length of hind legs	:	14 cm (5.6 inch)
Foot length	:	6.5 cm (2.6 inch)
Length of Arm	:	13.5 cm (5.4 inch)
Length of hand	:	4.5 cm (1.8 inch)
Head size (Perimeter)	:	18 cm (7.2 inch)
Girth	:	11 cm (4.4 inch)

DESEASE AND HEALTH CARE

Stump Tailed Macaque at Aizawl Zoological Park is generally healthy and had good body texture. Routine health check up is carried out to control the contagious and

infectious disease. Parasitic ova of *Strongyloides stercoralis* is found in three individual and successfully treated with Mebendazole. Skin infection is also notice in two individual of older age group and treated effectively with ivermectin. Tuberculin test is often conducted particularly for new arrivals at intra palpebral, no swelling or lesion notice when examination after 72 hrs. Other disease is not notice among the Stump Tailed Macaque except minor skin injury.

Feeding of animals

Stump Tailed Macaque was given a variety of locally available feed stuffs. Feeds are procured every morning and given to the animals at 7:00 A.M. after washing. Feed residue, urine and stool are clean and wash at 9:00 O'clock on the day itself. The feed stuffs are given as per the feeding schedule on daily basis depending upon the availability of feed in the market without fasting day. Drinking water also provided throughout the day at separate cells along with the feed.

Pregnant and nursing mother were occasionally given in separate cell or feeding trough otherwise the dominant male and its harem will consume more share of the food and the animal low in hierarchy will get less chance to feed. Breeding pairs are provided more quantity and nutritious feed for flushing as well as to make them strong vigor and better production.

Feeding schedule of Stump Tailed Macaque:

1. Pumpkin	-	300gm
2. Banana	-	300gm
3. Gram	-	100gm
4. Sugar cane	-	100gm
5. Papaya	-	100gm
6. Tomato	-	50gm
7. Bread	-	2 slice
8. Bean (s)	-	50gm
9. Ladies finger (s)	-	50gm
10. Carrot (s)	-	50 gm
11. Pineapple (s)	-	100 gm
12. Cabbage (s)	-	100 gm
13. Maize (s)	-	100 gm



CONSULTATION WITH ZOOS AND OTHER NGO'S

Zoos and NGO's in India having Stump Tailed Macaque are requested to send some information about the species we observed. Unfortunately we do not receive any information till to day.

RESULT AND DISCUSSION

Breeding season and characters

We have observed five numbers of female breeding pairs, the most favorable breeding seasons for Stump Tailed Macaque is between October to December and maximum numbers of birth seen in between June and July . During the breeding season, the dominant male copulated with high-ranking female throughout their estrus cycles. The duration of copulation observed at Aizawl Zoological Park lasts 5 – 10 minutes. Sometimes dominant male did false mounting without ejaculation. It is also frequently seen that the dominant male eat the semen from the tip of the penis and from the vaginal region after his dismount, at the same time, the female also take it out some of the semen from her vaginal region and consumed it all. Sometimes the lower ranking of male harassed the dominant male during copulation and may also copulate the younger female while the dominant male is mounting.

Gestation Period

As per our observation of five pregnant female, the pregnancy period is between 177 – 180 days. The female does not give birth every year and most of the female give birth every two years.

Physical and Physiological parameters of new born.

The physical parameter of new born is same either of the sex, but the measurement is little smaller in case of twin. The new born Stump tailed macaque have higher metabolic rate in comparison to adult. The normal birth new born parameter is as follows

1. Respiration - 55/min
2. Heart beat - 160/min
3. Rectal Temperature - 37.7°C
4. Weight - 440 gram
5. Arm length - 16cms (Without hand) (6.4 inches)
6. Ear length - 1cm (0.4 inches)
7. Tail length - 2.0cm (0.8 inches)
8. Length of hind leg - 27cms (with foot) (10.8 inches)
9. Length of hand - 5.3cms (2.12 inches)
10. Length of foot - 8cms (3.2 inches)
11. Length of body - 17cms (6.8 inches)
12. Head size - 21cms (8.4 inches)
13. Girth - 21cms (8.4 inches)
14. Hip - 15cms (6 inches)
15. Male genital organ - 1.8cm (0.72 inches)
16. Height - 17cms (6.8 inches)

Successful breeding of Stump Tailed Macaque

Enclosure design, natural vegetation, furniture, feeds and management are important criteria for successful breeding Stump Tailed Macaque. A very popular term 'Know your Species' becomes applicable to achieved breeding in captivity. Knowledge of breeding behavior, gestation period, Care of infant, developmental stages of infant to adult stage is an important behavior to consider for breeding. Efficiency of the manager as well as basic knowledge is the foundation for successful breeding. Similarly having an awareness of developmental stage of infant, breeding season, mating time, physical and physiological parameters of new born and adult as well as the care of infants are the important tools for successful breeding of this species.

To helps in conservation and increase population

During study period of one year, one of the most endangered species of Macaque give five numbers of new birth from the existing population fourteen numbers of Stump Tailed Macaque. The species is very rare in the local area and the existing population also rapidly decreasing due to unauthorized hunting and illegal killing. Since Stump Tailed

Macaque is one of the rarest macaque in India conservation and captive breeding becomes more important at present Producing five numbers of new born on every year may be an important tool for ex-situ conservation of the species at the local level and which may increase the population of Stump Tailed Macaque both in captive and wild . The finding of the project as mention earlier would be helpfull for wildlife practitioner worldwide.

Helps in Scientific management of Zoo animals

Basic knowledge of animal behavior, biology, physiology, breeding and reproductive behavior are the key tools for scientific management of zoo animals. The technique begins from the designing and construction of enclosure including the lay out of proper drainage system, installation of ventilation and provision of safety measure , feeding equipments and feeding schedule. Management of zoo animals without basic knowledge of advance management or scientific knowledge may not achieve the modern principles of zoo management. A manager should know what species he had to lookafter. All detail information for the management, breeding, conservation, effects of vegetation, care and handling about the Stump Taied Macaque have been studied and mention.

Conclusion:

As per the finding from our field observation, we can conclude that the Stump Tailed Macaque is multi male or multi female groups of animals. Groups are dominated by dominant male while the lower rank or juvenile play more important role in protecting the young one. Fighting is common among older males and sub dominant male present his rump to the dominant individual that acknowledge the gesture. Female developed sexual gland at three years of age and attains sexual maturity at four year and give birth when five year of age. Female generally give birth every two years after a gestation period of 177 – 180 days. One young generally born and occasionally twin born also occur. A twin born is smaller in size with a shorter gestation and the mortality of twin is very high in comparison to single born. Labor and parturition is seen only during night time, new born baby are white and cling to the mother and gradually become darken by age. Male Stump Tailed Macaque attains sexual maturity at five years, reproduction can be continued till seventeen years and average life span is thirty years. They move quadrupedally on the ground, terrestrial and not agile in tree. They spent more time on the ground and less in tree or night house. Juvenile and adult spent maximum time for playfight, grooming and foraging.







Pregnant Mother
at
night house



Unidentical twins

**EXPENDITURE STATEMENT OF RESEARCH ACTIVITIES ON
BREEDING OF STUMP TAILED MACAQUE
AT AIZAWL ZOOLOGICAL PARK**

Sl. No.	Items of Works	Amount in Rs. 1st Installment	Amount in Rs. 2nd Installment
1	Remuneration to staff	0.25 lakh	0.16 lakh
2	Preparation of site for breeding of Stump tailed Macaque	0.12 lakh	
3	Habitat improvement of enclosure	0.15 lakh	
4	Provision of hide for animal observation	0.15 lakh	
5	Purchase of field equipment for staff Such as: raincoat, umbrella, search light.	0.10 lakh	
6	Enclosure enrichment and procurement of food items	0.80 lakh	0.12 lakh
7	Purchase of books & journals	0.02 lakh	0.05 lakh
8	Local travels & conveyance	0.03 lakh	0.17 lakh
9	Consultation fee	0.02 lakh	0.10 lakh
10	Contingency	0.05 lakh	
11	Total	1.00 lakh	0.60 lakh
12	Total expenditure	1.00 lakh	1.60 lakh
13	Unspent balance	Nil	Nil

Aizawl Zoological Park Aizawl: Mizoram

Questionnaire on Stump Tailed Macaque in Mizoram

Name : _____

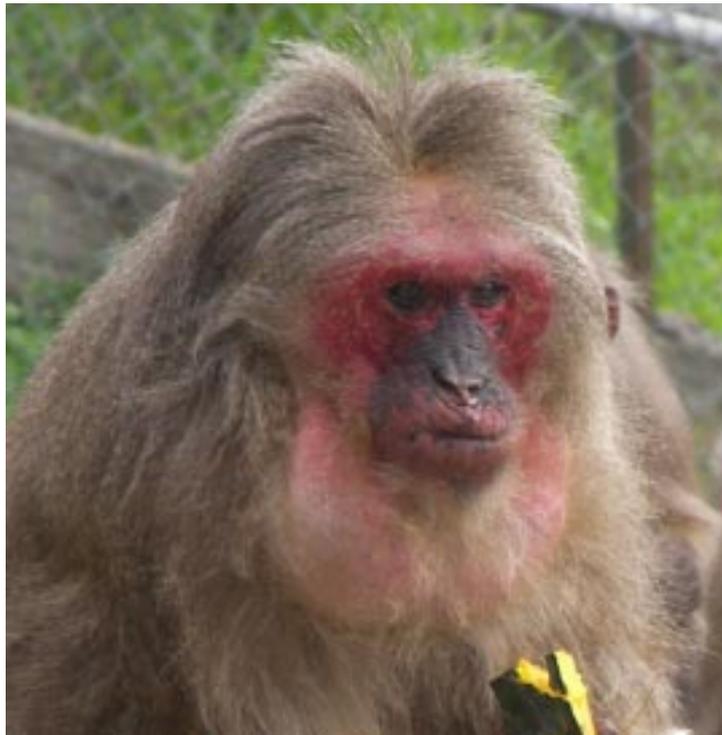
State/Region : _____

School/Office : _____

Sl.No.	Question	Answers
1	Do you ever seen Stump Tailed Macaque in Zoo?	
2	How many times?	
3	Do you ever see other monkey?	
4	Do you ever see monkey baby	
5	What is the colour?	
6	How many baby you have seen in single mother?	
7	Monkey is a solitary or social animal?	
8	Do you ever see Stump Tailed Monkey in other zoo?	
9	Do you see other monkey bigger than Stump Tailed?	
10	Are you interested in feeding of Monkey?	
11	Monkey is carnivores or not?	
12	How monkey is moving?	
13	Do you see the monkey fighting each other?	
14	What is the feed of monkey?	
15	Do you feel happy when you see the life monkey?	

Acknowledgment

We thank the Central Zoo Authority, a statutory body, Ministry of Environment and Forest, Government of India for providing financial support. We also thank Principal Chief Conservator of Forest, Government of Mizoram for necessary permission. We thank Chief Wildlife Warden, Government of Mizoram for providing us technical support and information. We also thank the Deputy Conservator of Forest, Wildlife Division for providing us assistant, space, laboratory and time to conduct this project and also the staff of Aizawl Zoological Park for their cooperation and encouragement. We thank Dr. Solanki, Reader and HT Remsanga Lecturer, Department of Zoology, Mizoram University for providing us information.



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COMMENTS ON CAPTIVE BREEDING BEHAVIOR OF STUMP TAILED MACAQUE RESEARCH AT AIZAWL ZOOLOGICAL PARK WITH REFERENCE TO TYPE OF HABITAT IN THE ENCLOSURE

INTRODUCTION:

A memorandum regarding “detailed study on captive breeding behavior of Stump tailed macaque” was signed between the Chief Wildlife Warden Mizoram and the Central Zoo Authority for initiating a small grant fellowship research to be headed by the Veterinary Assistant Surgeon at Aizawl Zoological Park.

Stump tailed macaque (*Macaca arctoides*) locally known as Zawng hmaisen (meaning red-faced monkey in Mizo) status given by South Asian primates with IUCN red list as critically endangered and put under C2a(i) i.e. small population with <50 mature individuals in each sub population (source South Asian Primate C.A.M.P summary, Coimbatore, 2004), is also listed under schedule II in Wildlife (Protection) Act, 1972.

OBJECTIVE AND STUDY:

The main objective of the pilot project study was to ascertain the animal behavior on captive breeding, reproduction, physiological and physical parameters to help conserve and improve in scientific management of the existing condition.

The following aspects of animal with respect to Social and organization behavior, sexual behavior and reproductive performance had been studied by the team. Observations also include mating season, frequency, time interval between successive copulation, gestation period, birth interval, infant care, adaptation and related behaviors under captive condition. These studies help us to gather the basic facts about the characteristic behavior of target species.

SUMMARY, FINDING AND SCOPE:

The study highlights that animal has the capacity to establish effective social controls to meet the situation inside enclosure which have been constructed large enough to meet its requirement. The growth, limitation and survival of population are related to the behavior of its members through social & ecological organization.

Some interesting and commendable findings from the study of a dozen population of stump tailed macaque reveal that –

- Five breeding pairs are observed during the research period indicating prolific breeding of studied animal.
- Stump tailed macaques are not seasonal breeders.
- They are found not sexually active at night.
- Little or no copulation noticed in early morning and late evening.

- Maximum mating seen in the fore noon between 9:00 to 12:00 am.
- Most favorable mating season is October to December during which 55.52% mating of the year take place.
- The process of copulation generally lasts from five to ten minutes.
- False mounting without ejaculation also happens.
- Twin delivery, very rare case, also takes place. However gestation period shorter and new born babies are also smaller and lighter.
- A new born baby is given necessary parental care by its mother from the very birth, other members also attended but nursing done by the mother only.
- No sign of labor (Parturition) known five hours before giving birth.
- Pregnancy and birth usually not every year, rather once in two years.
- First recorded sitting of baby after 15 days noticed in the night house and after 30 days on the ground outside feeding cubicle.
- When a male macaque is attacked by another male of higher hierarchy the later shows redirected aggression towards subordinate individual.
- Though stump tailed macaque is arboreal, under captive condition the animal is not so agile on trees as on ground therefore more terrestrial in behavior.
- Adaptability of the species or flexibility in its adaptation in the new enclosure with open space natural environment is one advantage for captive breeding and survival of the animal.

There is still scope to study in future about inbreeding and its impact to the group; stereotypic behavior of over population in limited enclosure; adaptive behavior when shifted to new enclosure; behavioral and physiological change due to change in feeds, stress, disease, physical environment etc. which could not be covered this time due to specified objective as aforesaid earlier.

FUNDING:

As per agreement 50% of the budget i.e. Rs. 1.00 lakh was released by the CZA during 2006 vide F.No.9-2/2006-CZA dt.17.10.2006 and 30% of the budget i.e. Rs. 60,000.00 by demand draft dated 12.7.2007. At the end of the first year a progress report on research project indicating introduction and background history, Aims and objectives, Isolation and breeding cell, Methodology, Behavioral study, Physical and Physiological parameter, Feeding schedule of animals and Expenditure statement etc. was submitted to CZA. The final and remaining installment of 20% i.e. Rs. 40,000.00 is yet to be received by the project implementing agency.