

BEHAVIOUR AND ECOLOGY OF WILD AND CAPTIVE ASIAN ELEPHANTS

Fred Kurt

1. Present distribution of Asian elephants and population trends

2000 years ago Asian elephants occurred from the Euphrat in the west to Central China in the east. Today the last wild elephants survive on relative small "islands".



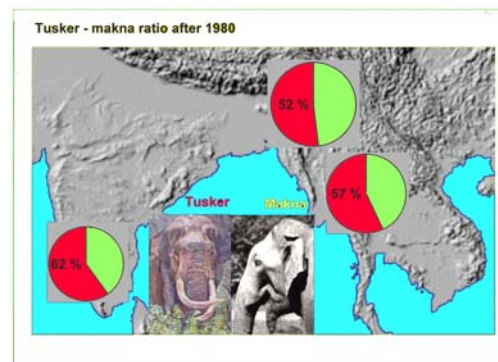
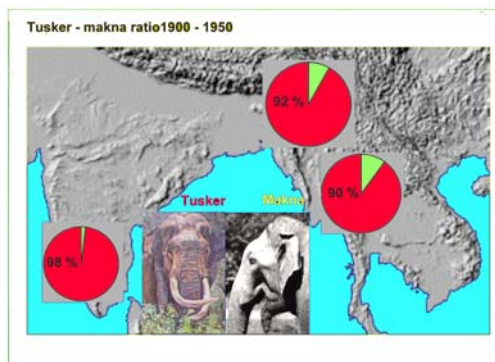
Population estimations (Sukumar, 2003)

Country	Minimum	Maximum
India	26.390	30.770
Nepal	100	125
Bhutan	250	500
Bangladesh	150	250
China	200	250
Myanmar	4.000	5.000
Thailand	2.500	3.200
Laos	500	1.000
Cambodia	250	600
Malaysia	2.100	3.100
Indonesia	2.400	3.400
Sri Lanka	2.500	4.000
Total	41.410	52.345

2. Tuskers and maknas

In Asian elephants only bulls carry tusks (elongated upper incisors). Some bulls are tuskless and called maknas. Maknas and females can carry tushes. Tushes are smaller elongated upper incisors. Some maknas and females have no tushes at all.

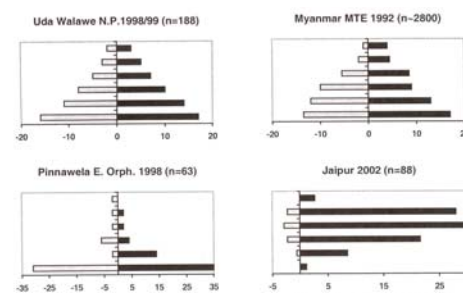
In Sri Lanka tuskers are rare (only about 10% of all bulls). On the Asian mainland, the number of tuskers decreases and the number of maknas increases due to selective poaching of tuskers for ivory.



3. Social classes

	approx. age	remarks
Neonates	1 – 2 years	Suckle
Infants	3 – 4 years	
Juvenile	5 – 9 years	Puberty at end of this period
Subadult	10 – 15 years	Reproducing* But not full grown
Adult	older than 15	Reproducing & Full grown

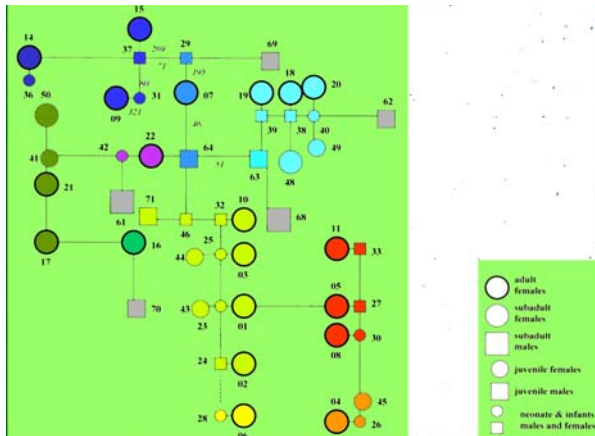
* in wild elephants subadult males do not reproduce.



Structures of 4 different populations. For details see later.

4. Clans and mother – families

Females and their offspring live in mother-family-groups of 2 to 9 members. Several closely related families form clans of 40 to 70 members.

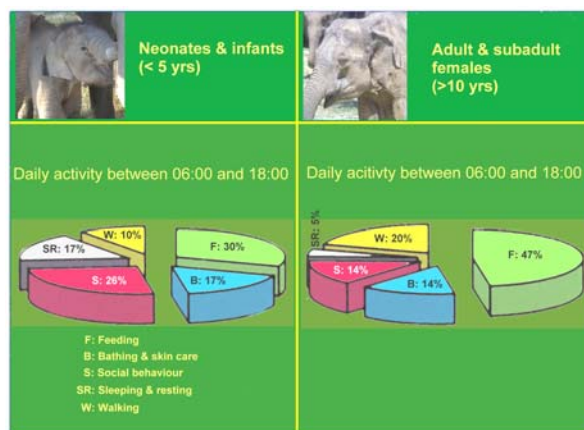


Resting mother family. Younger animals sleep

Left: Organisation of a clan (Yala National Park, Sri Lanka)

5. The daily activity and social roles

Females show different patterns of daily activity than neonates and infants. Females spent more time with feeding and walking. Babies sleep, play (social behaviour) and bath more than females.



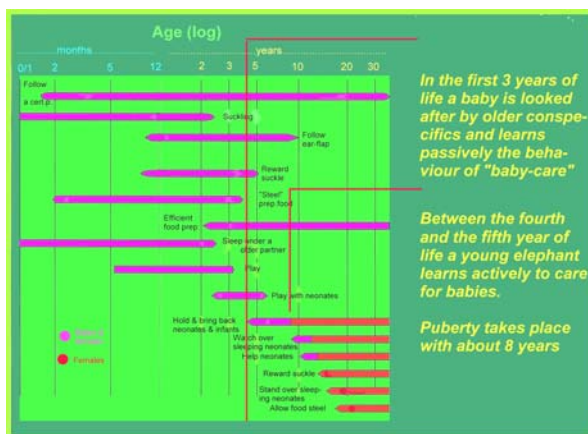
Each member of a family can take over certain social roles, e.g. watch and protect babies,



bring back babies in group,

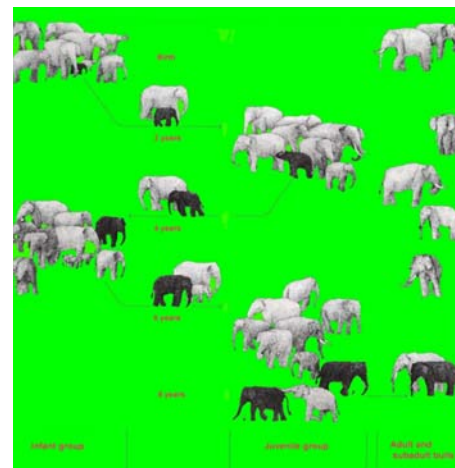


Protect family (from crocodile)



Social roles according to age. Lines indicate, when a certain role appears and when it ends.

When a baby is about 4 years old its mothers gives birth again. When the first offspring reaches the age of 8, the next baby is born.

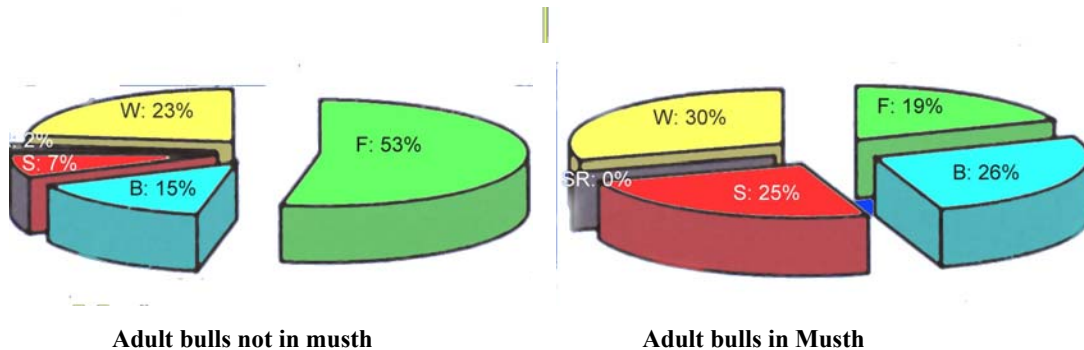


Model of clan. Mothers and their offspring change according to the age of the youngest offspring between infant – and juvenile units. Adult bulls stay at the periphery. Only musth bulls are in family groups.

6. Bulls and musth

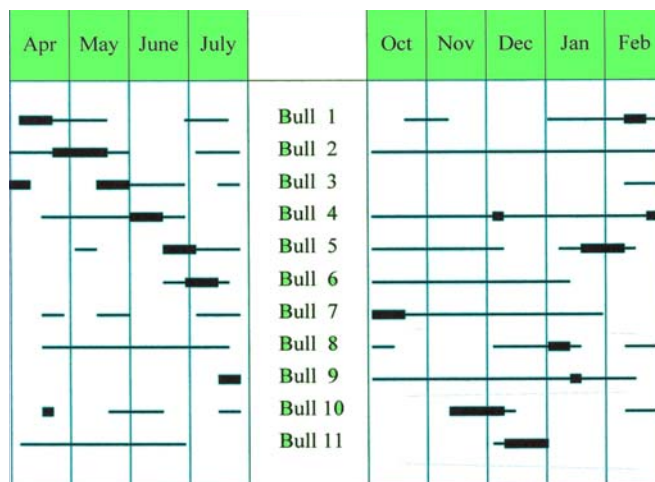
At the age of 5 years (and before puberty), bulls separate increasingly from the families of their mothers and join bull groups, where they establish rank hierarchies. They reach puberty between 8 and 10 years. Although they would be physiologically able to reproduce, they are not allowed to mate since females prefer adult bulls short before or at the beginning of their individual musth period.

Musth means rut: The testicles are enlarged. The testosterone level is extremely high. The temporal glands are active. Their secretion is mixed with water and substrate and smeared over the head and at certain marking trees. Musth bulls are socially very active, stay in family groups and hinder other adult bulls to come close to oestrus females. In wild elephants successful mating is carried out by bulls short before or at the beginning of their musth.



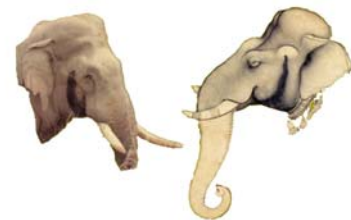
Daily activity between 6 a.m. and 6 p.m. of wild adult bulls. F: feeding; B: bathing; S: social behaviour; SR: sleep & rest; W: Walking.

Musth bulls eat less, but bath and walk more than non -musth bulls. Socially they are extremely active.



Left: Musth periods (broad lines) of 11 adult bulls in the Yala National Park (Sri Lanka). Thin lines indicate the presence of the bull concerned in the observation range.

There is always one bull in musth. However, the musth periods of different bulls hardly overlap.



Left: During bathing musth bulls mix the secretion of the temporal gland with water and mud and smear it over the head.

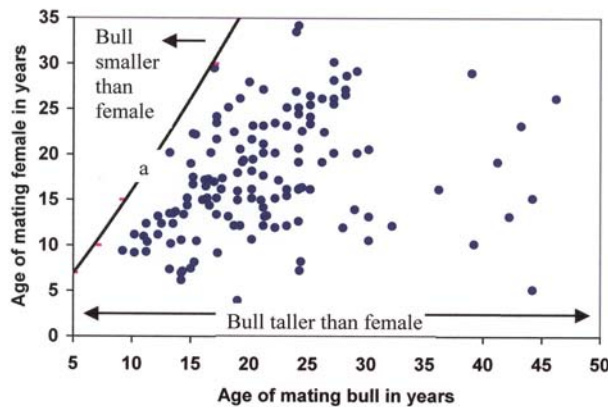
Right: Later they rub the mixture on certain trees to mark their presence.



7. Reproduction

In bulls and females puberty takes place in the age of 8 to 10 years. Females reproduce already in subadult ages. Males only when they reached adult age. In captivity bulls can reproduce earlier. However, only very young, i.e. „small“ females mate with very young bulls.

Gestation period lasts between 18 and 24 months. It seems to be longer in zoo elephant than in timber and wild elephants in the countries of origin. The interval between 2 consecutive births lasts 4 to 6 years. After a stillbirth it last only about 2 years.



Left: Age of mating pairs in Western zoos. Bulls in relative young ages mate successfully only with smaller females. Mating bulls could be younger than females, but they were never smaller.

In wild elephants a female in oestrus attracts a number of adult and subadult and many juvenile bulls. First juvenile and subadult bulls are present. Short before mating takes place, an adult musth-bull appears. He chases other adults and subadults away. Juveniles remain with the group. When mating takes place, the juvenile males start to imitate the mating bull and mount smaller conspecifics.



Subadult bull tries to mate with an adult female



Subadults are driven away by a particular adult bull



Female choice is in favour of adult bulls in musth

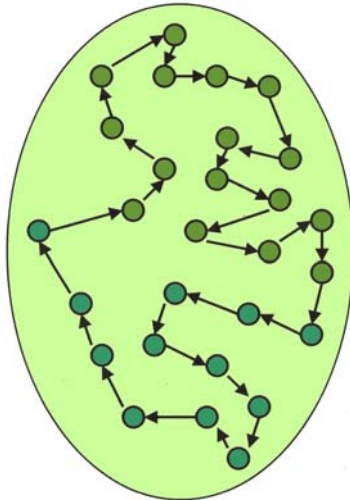


During mating juvenile bulls drive small elephants and try to mount

8. Home range

During dry seasons Asian elephants retreat to higher altitudes. During the rains they appear in the valleys. The movement of a clan can be described as follows: Its members stay together between momentary clan centres (mainly water holes). At these centres the families follow own routes. A momentary centre is left, when food resources become scarce.

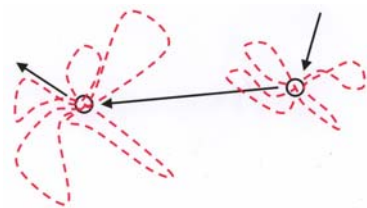
Sleeping places are important parts of the daily range. They are found under trees on dry ground. A sleeping place is used for one night. In the next night the group rest at a different location. An particular resting place is visited again only after insects have removed the dung.



Within their annual home range, clans move from one to another centre.



Family groups in South India (Nilgiris). During the dry season the herds are in high altitudes. During the rains they appear in low lands. (Photo: Ajay Desai)



In momentary centres family groups separate from each other. A centre is left, when food resources become scarce and or ectoparasites like horse – flies (right) increase.



Size of home ranges (in km²):

	Clans	Adult bulls
Sri Lanka: Ruhuna (Yala)	40 – 121	?
Gal Oya	40 - 60	?
Uda Walawe	40 - 60	?
South India:	530 – 800	211 – 235
Bengal:	230 – 3700	
North India:	100 – 400	200
Myanmar:	610	
Malaysia:	60 – 170	32 - 38

Daily movements:

Family group with neonates: 1 – 5 km

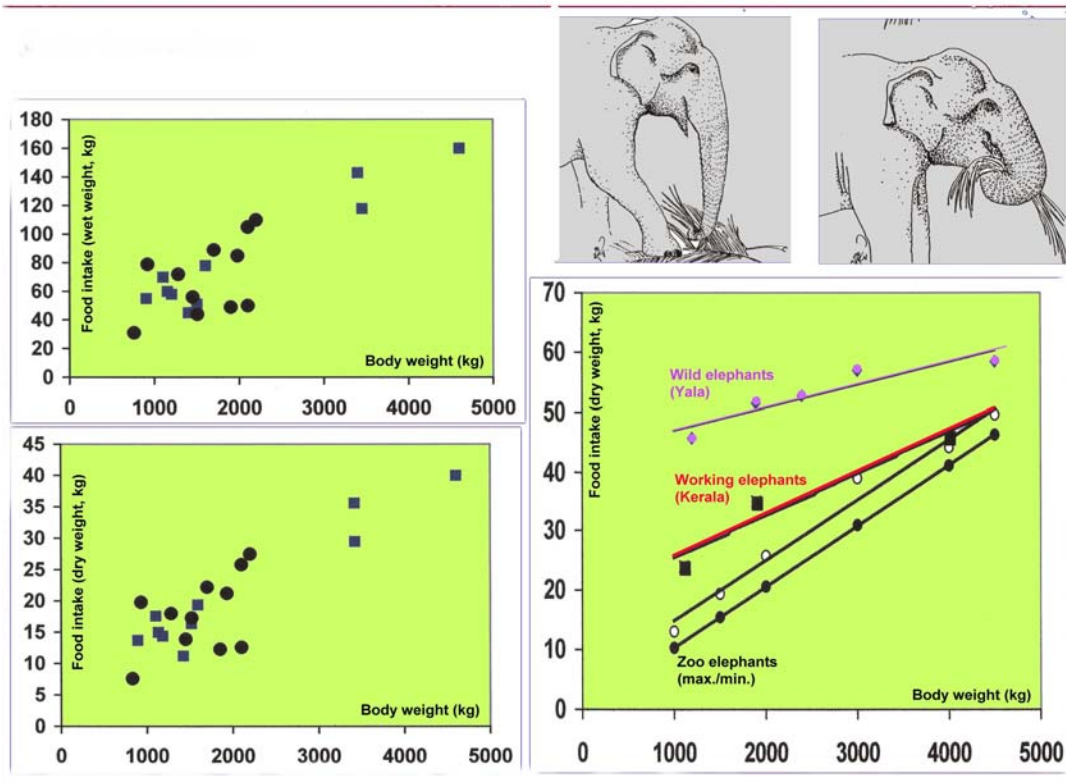
Family group with infants: 1 – 9 km

Daily range of family group: 0,1 – 1 km²

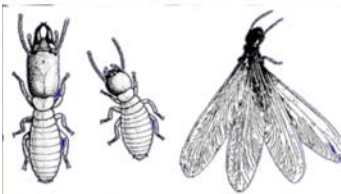
Daily movement of zoo elephants: 1 – 7 km

9. Food

Elephants live from a considerable number of different grasses, herbs, bushes, trees and fruits. Their digestive abilities are rather low and a fibrous material as well as many seeds leave their digestive system undigested.

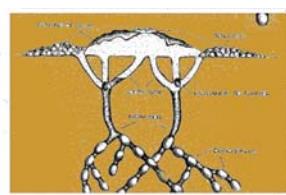


In elephant dung fungi grow. A number of tropical fruit plants (like the wood apple) germinate mainly in elephant dung.



Termites are attracted by fibrous material in the faeces. This material is brought into the termite mound and converted into digestible matter.

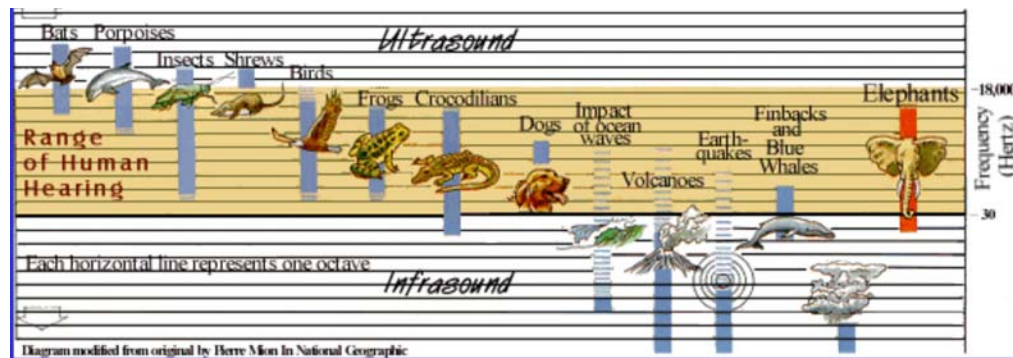
Termites transport important nutrient from deep soil layers to the top. Furthermore the tunnels dug by termites allow air and water to reach deeper soil layers.



Dung beetles play a similar role as termites. In Africa as well as in South Asia a number of dung beetle species specialised on elephant dung.

Because of its important ecological impact the elephant is considered as keystone species.

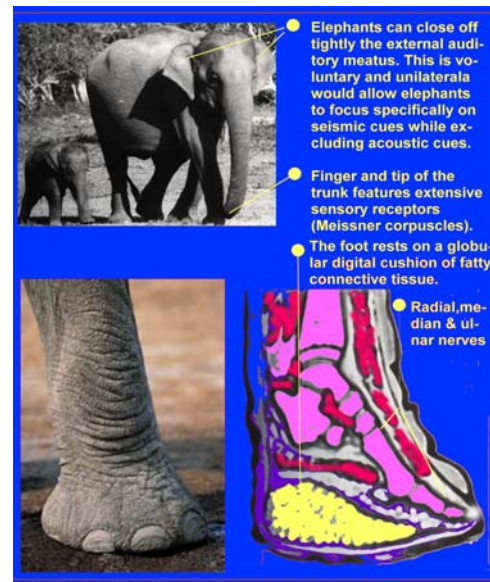
10. Auditory communication



Basic	Modification	Result	Contact
Growl	1. None	Growl	Short-dist. cont.
	2. Resonate in tr.	Rumble	Mild arousal
	3. Incr. Amplit.	Roar	Long dist. cont
	4. Low frequency	„Motorcycle“ *	
Squeak	1. short squeaks	Chirping	Conflict
	2. incr. Amplitude	Trumpet	Extrem arousal
Snort	1. None	Snort	Activity-change
	2. Incr. Amplitude	Snort	Increasing arousal
	3. same as 2 plus bounce trunk tip on ground	Boom	Threat display
	• Infra sounds in different contexts of long-distance contacts		

Acoustic waves reach a distance of 3 to 6 km,
Velocity: 309 m / sec

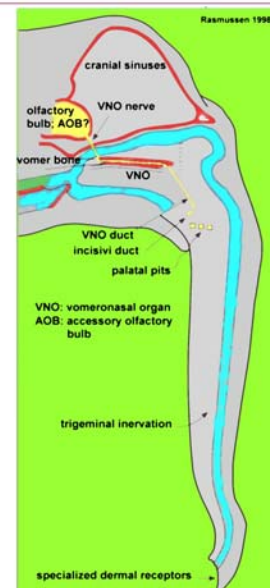
Seismic waves reach distance of 32 km
Velocity: 250 m / sec



11. Chemical communication



The system of chemical communication is highly sophisticated. Chemical signals are broadcast from glands & mucous membranes. The trunk plays a chemosensory role next to the vomeronasal organ (VNO) and the palatal pits. The elephant's nose is believed to be five times as sensitive as that of a bloodhound. Some chemical signal of females in pre-ovulatory state are found also in many female insects (many butterflies) to attract mates.



Rasmussen 1998, Sukumar 2003

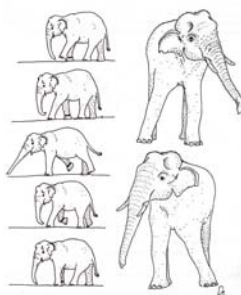
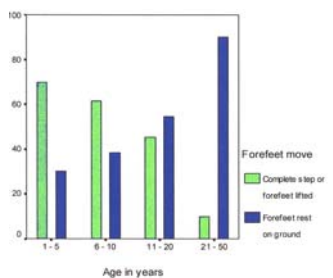
12. Stereotypies

Stereotypies are repetitive invariant behavioural patterns that have no obvious goal or function. In captive Asian elephants they have been described as intentions to fore- and back-steps accompanied by body and trunk swaying in forwards and backwards, or side-wards movements on the spot, head nodding, often accompanied by trunk swinging and are known as "weaving". Weaving is always associated with intensive keeping systems, i.e. more or less permanent chaining in small stalls, where living conditions deviate fundamentally from the natural environment in which the animal's behavioural organisation has been shaped by evolution. Accordingly stereotypies are generally considered as indicators of poor welfare.

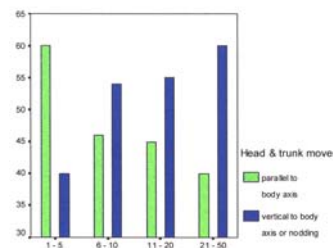
Weaving can be considered as ritualised appetitive behaviour. Appetitive behaviour can be observed when an animal is motivated to perform a specific behaviour pattern but cannot perceive the adequate releasing stimuli. The animal then starts to look for these stimuli by exploring their environments. Orphaned young elephants kept on ropes in their first month in captivity without access to conspecifics pull often on their fetters and try to free themselves. Occasionally they rest in recumbent position and exploratory behaviour appears often, social behaviour is rare. Elephant living since at least 3 months mainly on ropes, have established already their stereotypies, spend more than 50% of the day with weaving. It was found that stereotypies are triggered not only by lack of free movement but first of all by lack of adequate social partners. Later weaving appears under different conditions. Stereotypies are a symptom rather than a cause of a serious pathological process which starts with social isolation in young age and retarded body growth, and is followed by delayed puberty and/or foot problems due to the permanent weaving in unusual position. Weaving can be cured only at the beginning of captivity. Later, when the stereotypy is "frozen" it rests for the rest of the life.



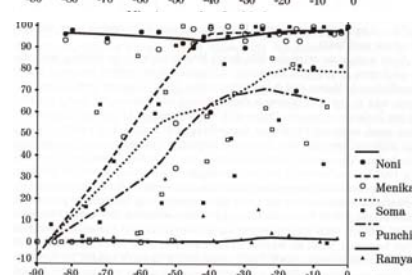
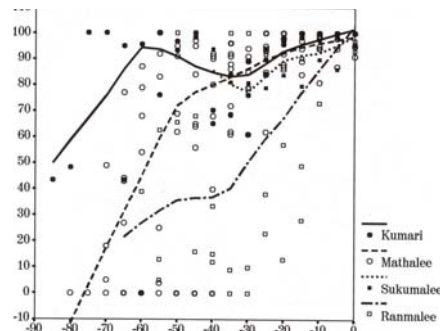
In the beginning of captivity elephants try to free themselves from the ropes (left) and fall in lethargy (right)



Above: Weaving evolves from forward steps and changes increasingly in swaying movements.



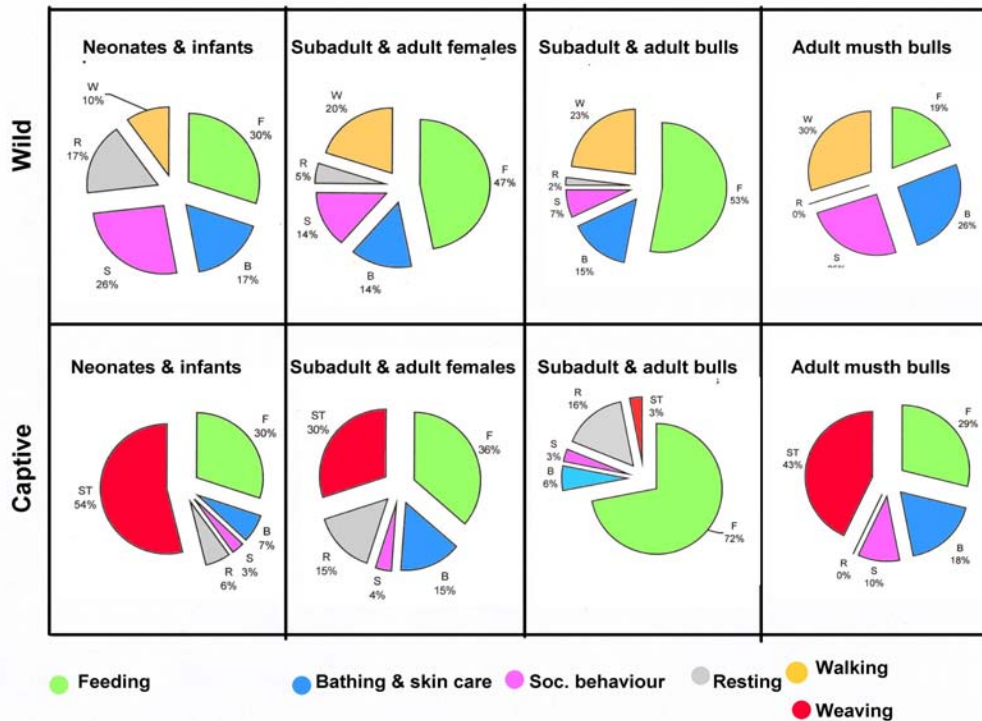
Movement of forefeet (top) and head & trunk (below) during weaving according to the time in captivity



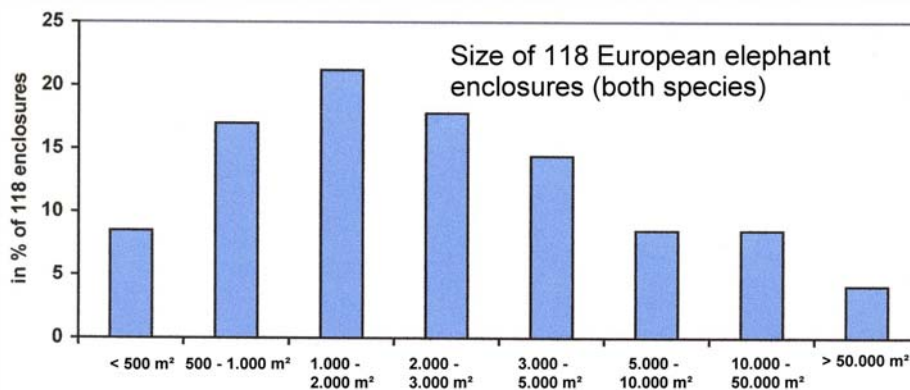
Time spent with weaving before meeting with family members in mothers (top) and juvenile females (below). Not socialised juveniles either weave permanently or are too weak to do so.

13. Daily activity

Daily activity of wild and fettered elephants between 6 a.m. and 6 p.m.



14. Size of elephant enclosures



Tennis court (260 m²)



Ice hockey field (1.640 m²)



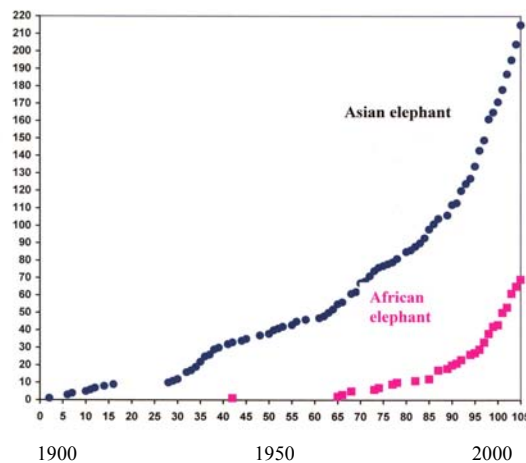
Soccer field 7.300 m²

Size of momentary range in wild elephants: 10.000 - 250.000 m²

15. The present population of both elephant species in European zoos*

	Asian elephant	African elephant
Total population:	300 (61 bulls; 239 females)	217 (50 bulls; 167 females)
Captive born:	80 (41 bulls; 39 females) 26,7%	51 (23 bulls; 28 females) 23,8%
Number of establishments:	83	55
Number of breeding establishments:	23 27,7%	13 23,6%
Elephants in breeding establishments:	158 (42 bulls; 116 females) 52,7%	102 (27 bulls, 75 females) 47,0%

* including Ramat Gan (Israel)



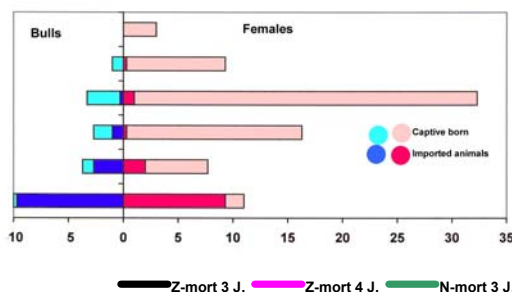
Reproduction rate:

Since 1992 109 births of **Asian elephants** were recorded in European zoos, i.e. more than in the 90 years before.

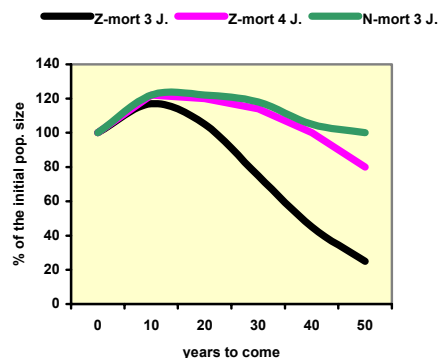
Since 1992 48 births of **African elephants** were recorded in European zoos, i.e. more than twice as many as before.

Although there is an elephant baby boom at present, the populations of both species will hardly increase and a decrease can be expected if juvenile mortality remains as high as at present. Mainly in the Asian elephant the population contains many old animals.

Furthermore only about 50% of elephants live in breeding herds.



Left: Population structure of captive Asian elephants in European zoos is depicted as "pyramids". Left side: bulls; right side: females. 6 age classes of 10 years are distinguished. Lowest bar: animals between 1 and 10 years; top bar: animals between 51 and 60 years. Data are given in % of total population. The total population is skewed towards females. In the captive born population both sexes occur equally.



Left: Computer –model of the theoretical development of captive Asian elephant population in European zoos under 3 assumptions: (1) If the zoos cannot reduce the relative high neonate and infant mortality and females have only 3 offspring, the breeding population breaks down within the coming 50 years. If it is possible to reduce the neonate and infant mortality the breeding population survives even when only 3 babies are born per female.