



Variation in social organisation of lions with particular reference to the Asiatic Lions *Panthera leo persica* (Carnivora: Felidae) of the Gir forest, India

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Abstract: Sociality is one of the distinctive features of Lions (*Panthera leo*), which are the only social felids. Their evolutionary history is important both for understanding the evolution of sociality and that of other sympatric species owing to their widespread distribution throughout the entire Holarctic region during the Pleistocene. Lion grouping patterns, cooperative behaviour and strategies vary throughout their range and in different habitats. Their resilience in diverse habitats facing a variety of conservation pressures is largely owing to this plasticity of lion social behaviour. This review describes the variation in social organisation of lions in 11 habitats across Africa, taking into account relevant ecological parameters. The social organization of the Asiatic Lion is described from this perspective using the results of previous studies and of a five-year study conducted between 2002 and 2006 in the Gir forest of India.

Keywords: Asiatic Lion, Gir protected area, *Panthera leo*, social organisation

INTRODUCTION

Carnivores are mostly solitary (Ewer 1973). However, certain taxonomic groups among carnivores, such as canids and herpestids, have a tendency for social living (Gittleman 1989). Since social living does not show a serial evolutionary trend across taxa, it appears that group living has evolved in each major taxonomic family independently across the order (Gittleman 1989). Diverse selective pressures, such as optimum resource exploitation, competition and reproduction have contributed to the evolution of sociality among carnivores, the basis of which has been reviewed by several authors (Eaton 1979; Macdonald 1983; Gittleman 1989). Hunting and killing of large prey, anti-predator defence, social learning and information transfer, alloparental care, and survival in hostile environments are potential advantages that promote social living (Macdonald 1983; Gittleman 1989). The resource dispersion hypothesis explains the evolution of sociality, and states that dispersion and abundance of resources causes variation in the social system of carnivores (MacDonald 1983). These variations are moulded both by ecological constraints and benefits (MacDonald 1983). Typically, there are several types of carnivore grouping that represent functional responses to both the environment as well as kinship and relatedness, namely foraging groups (related to hunting success), feeding groups (related to sharing of food), population groups (related to sharing a common home-range) and breeding groups (related to mating) (Gittleman 1989). Behaviours such as guarding of foraging and breeding grounds, mutual regurgitation, sharing of reproductive opportunities among group members and communal suckling or rearing of young ones have been associated with kin selection (Bertram 1979).

Felids exhibit intraspecific variation in sociality: Leopards (*Panthera pardus*) are solitary (Bailey 1993), Tigers (*Panthera tigris*) are capable of social living (Sunquist 1991) and male Cheetahs (*Acinonyx jubatus*) exhibit facultative sociality to improve their reproductive success (Caro 1994), while Lions (*Panthera leo*) are the only truly social carnivores among felids (Bertram 1975). Group living thus distinguishes lions from rest of the *Panthera* group (Yamaguchi et al. 2004).

Discussions of sociality in carnivores usually involve comparisons with lions (Sunquist 1981; Caro 1994; Stander et al. 1997), which live together in social units called prides that are described as fission-fusion interactions (Schaller 1972). Group territoriality, group hunting and communal cub rearing form the basis of social cooperation (Grinnell et al. 1995; Heinsohn & Packer 1995) that are distinguished as optimum foraging groups that maximise hunting success (Clark 1987; Giraldeau & Gillis 1988), associations that counteract competition with other species (Coraco & Wolf 1975; Cooper 1991) and associations that maximise reproductive success (Packer & Pusey 1982). The lion social

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structure defines the way in which available resources are used or shared. This aspect of lion sociality has been well documented in the Serengeti Lions of Africa (Schaller 1972; Bertram 1975; Packer & Pusey 1982; Packer & Pusey 1983; Packer & Pusey 1987; Packer et al. 1988; Grinnell et al. 1995). However, the fact that lions do not form standard patterns of social living is often overlooked. Lion social systems are dynamic and vary with respect to habitat, anthropogenic pressures, dependency on livestock, prey availability and competition (Schaller 1972; Cooper 1991; Hanby et al. 1995; Hemson 2003; Funston et al. 2007). While popular conceptions of lion social behaviour are based on the predominant literature on lion behaviour in the open plains of the Serengeti, several recent studies have focused on providing a broader perspective on African Lion populations. Some studies have reviewed the population, density and status of lions across Africa (Chardonnet 2002; Bauer & van der Merwe 2004), while others have reviewed the social organisation of lions (Hemson 2003; Purchase 2004; Funston 2007) based on chosen habitat variables, albeit in varied contexts. A detailed review, taking into account prey and diet parameters (including livestock uptake), habitat and climate, social structure, density, home-range has not been undertaken. It may be possible to ascertain or speculate on the drivers of patterns of lion social organisation in different habitats if such a database is made available. This review presents baseline data on lion social organisation and habitat-specific ecological parameters (Table 2-4), including pride and coalition composition, male-female interaction, pride size, home-range, habitat, prey availability and competition. The data has been sourced from the literature and personal communications with experts in the field.

Genetic variation of lion populations

The evolution of modern ungulates, the radiation of *Felinae* as well as the extinction of the earliest known ancestor of modern cats, the sabre-tooth cats, occurred during the Pleistocene (Turner & Anton 1997). Members of *Panthera* share a common lineage up to the Pliocene, and later lions developed distinctive features, such as group living and manes (Yamaguchi et al. 2004). Lions have attained a wide distribution range during their evolutionary history and have influenced the evolution of many sympatric species (Eisenberg 1981). Thus, an understanding of their evolutionary history is of great importance to understand the evolution of other prey and carnivore species, as well as the evolution of cooperative behaviour.

Two models have been proposed to explain the diversification of lions: multiregional origin and single origin replacement (Barnett et al. 2006). The former proposes long-term evolution and diversification of present-day lions, while the latter proposes that a single population of lions replaced the older populations in Africa and southwestern Eurasia following a population bottleneck (Yamaguchi et al. 2004; Barnett et al. 2006). Two distinct lineages, namely the Holarctic Cave Lion (*Panthera leo spelaea*) and the Modern Lion (*Panthera leo* spp.) existed at the end of Pleistocene (Burger et al. 2005). Traditionally, 12 and later eight subspecies of *Panthera leo* had been classified based on location, mane appearance, size and distribution (Burger et al. 2005; Barnett et al. 2006) (Table 1). Lions are classified into three geographic populations on the basis of their recent evolutionary history, namely, northern

African-Asian, southern African and middle African populations (Barnett et al. 2006).

Recent studies on the phylogeographic history of modern lions based on analysis of mitochondrial DNA sequences have concluded that the limited variations do not merit taxonomic distinction among extant African Lions (Dubach et al. 2005), thereby indicating a single African origin model of modern lion evolution (Barnett et al. 2006). Based on the above studies, all sub-Saharan lions are classified into a single subspecies (O' Brien et al. 1987; Dubach et al. 2005). However, they may be divided into two main clades to the west and east of the Great Rift Valley, based on the fact that lions from Tsavo in eastern Kenya are genetically closer to lions in the Transvaal (South Africa) than to those in the Aberdare Range in western Kenya (Barnett et al. 2006).

Two distinct subspecies of extant lions, namely, *Panthera leo leo* and *Panthera leo persica* have been recognized to have diverged in recent times, about 55,000 and 200,000 years ago (O' Brien et al. 1987). Free-ranging lions today exist as two disjunct populations: *P. l. leo* in Africa and *P. l. persica* in India. The former are presently found in savannah habitats across sub-Saharan Africa, while the only living representatives of the latter occur in the Gir forest of India (Nowell & Jackson 1996).

Asiatic lions: Distribution and status

Historically, the Asiatic Lion had a wide distribution extending from Syria across the Middle East to eastern India (Kinneer 1920; Joslin 1973). Within the Saurashtra region they were found in Dhrangadhra, parts of Jasdan, Chotila, Alech hills, Barda hills, Girnar and Gir (Dalvi 1969). By the turn of the 19th century the lion population was fragmented, and ultimately became limited to the Gir forest (Dalvi 1969). In recent years an increase in lion populations has resulted in an increase in density within Gir, and consequently lions have dispersed and established themselves outside the protected area (Singh 1997). The present population estimate is 359 lions, including 291 within the protected area and "satellite populations" of 68 (Gujarat Forest Department census report 2005).

African Lions: Distribution and status

The African Lion population has been estimated to be between 16,500 and 30,000 (Bauer & van der Merwe 2004). They exist both as fragmented populations in west and central Africa, and as a continuous large population in east and southern Africa (Bauer & van der Merwe 2004) (Fig. 1).

Lion Social Organisation: Classic pattern from studies in the Serengeti

A pride consists of 2-18 females and a coalition of males that have entered the pride from elsewhere and associate with it during their tenure (Schaller 1972; Bertram 1975; Bygott et al. 1979; Packer & Pusey 1982). Interestingly, there appears to be no functional dominance hierarchy within prides (Schaller 1972; Bertram 1975; Bygott et al. 1979; Packer & Pusey 1982). Female companions of a pride are always closely related, male companions are either closely related or unrelated, and mating partners are usually unrelated (Packer et al. 1991).

At the age of three, subadult females are either recruited into the pride or driven out of it depending upon the existing adult population (Bertram 1975). At three years of age male

Table 1. Subspecies classification of lions (Burger et al. 2004).

spelaea Group	
<i>P. l. fossilis</i>	Early Middle Pleistocene European Cave Lion
<i>P. l. vereshchagini</i>	East Siberian or Beringian Cave Lion
<i>P. l. atrox</i>	North American Cave Lion
<i>P. l. spelaea</i>	Upper Pleistocene European Cave Lion
leo Group	
<i>P. l. persica</i>	Asiatic, Persian or Indian Lion
<i>P. l. leo</i>	(Barbary Lion) All extant African Lions
senegalensis Group	
<i>P. l. senegalensis</i>	West African Lion
<i>P. l. azandica</i>	North East Congo Lion
<i>P. l. nubica</i>	East African or Masai Lion
<i>P. l. bleyenberghi</i>	Southwest African or Katanga Lion
<i>P. l. krugeri</i>	Southeast African or Transvaal Lion
<i>P. l. melanochaita</i>	Cape Lion

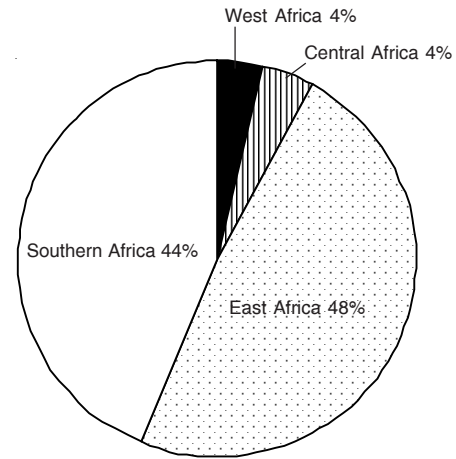


Figure 1. Distribution of lions in Africa (Bauer & van der Merwe 2004)

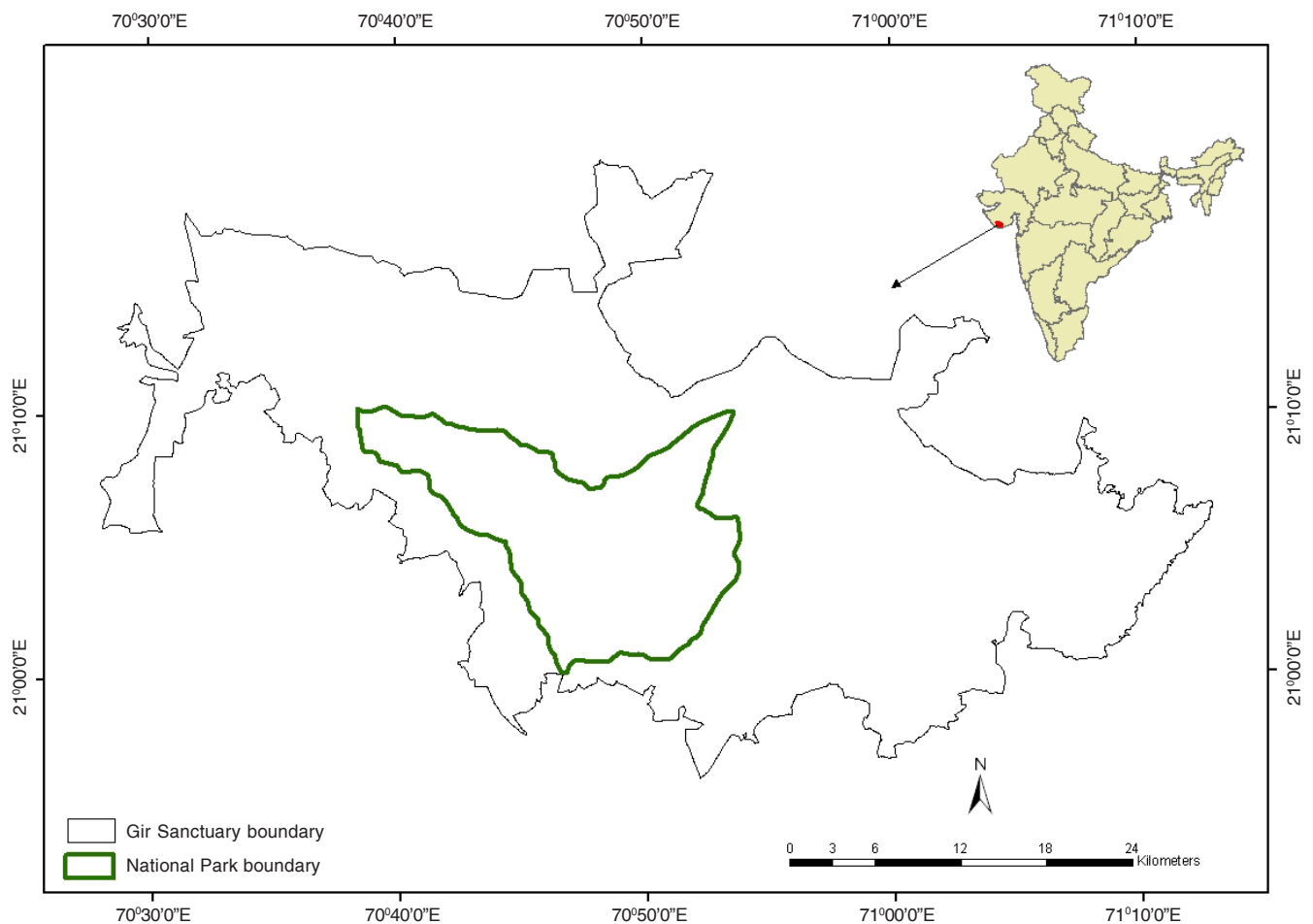


Figure 2. Location of the Gir Sanctuary and National Park in western India

lions are either expelled or leave their natal prides voluntarily (Bertram 1975). During the nomadic phase of their lives they form coalitions of 2-9 individuals with either brothers and cousins from the same pride or with non-related males (Packer & Pusey 1997). A successful coalition gains temporary but exclusive access to a group of females until ousted by another coalition (Bygott et al. 1979). Successful male coalitions become resident in their first pride when they are about four years old

(Packer & Pusey 1987), and typically remain in a pride for 2-3 years, fathering only one cohort per pride (Packer et al. 1988). Nomadic lions are not necessarily of a different population, but are surplus from the resident breeding populations (Schaller 1972; Bertram 1975). Most nomads are males looking to establish and wrest control of prides from other coalitions (Schaller 1972) and include both sub-adult males and old males expelled from their territories by other males (Schaller 1972).

Table 2. Description of location and habitat of lion habitats

Study area	Region	Country	Park area (km ²)	Vegetation	Cover	Author & Source
Kruger NP	Southern Africa	S. Africa	23,700	Open woodland savanna	Mixed	P.J. Funston pers. comm.
Greater Tsavo Ecosystem	East Africa	Kenya	20,000	Acacia – Commiphora woodland	Medium	B. Patterson pers. comm.
Selous Game Reserve	East Africa	Tanzania	92,000	Wooded savanna, <i>Miomom Combretum</i> thickets	Medium	Spong 2002
Etosha NP	Southern Africa	Namibia	22,270	Short grass plains	Open	Stander 1992
Serengeti	East Africa	Tanzania	40,000	Acacia woodlands /plains	Open	Hanby et al. 1995
Luangwa Valley	Southern Africa	Zambia	355	Mixed	Medium	Yamazaki 1996
Mid - Zambezi	Southern Africa	Zimbabwe	2,196	Alluvial/ Colophospermum/ dry	Closed	N. Monks pers. comm.
Masai Mara NP	East Africa	Kenya	1,530	Open wooded grassland		Ogutu & Dublin 2002
Ngorongoro Crater	East Africa	Tanzania	250	Savanna	Open	Hanby et al. 1995
Chobe NP			11,700	Savanna	Mixed	Cooper 1991
Hwange NP	Southern Africa	Zimbabwe	14,600	North-west area: <i>Coleospermum</i> mopane woodland and scrub. Kalahari sand: <i>Baikiaea plurijuga</i> woodland	Mixed	Loveridge 2005
Gir Sanctuary and NP	Gujarat State	India	1,883	Dry teak forest	Mixed	Pathak et al. 2008

Table 3. Details on prey related parameters and competition for the lion habitats

Study Area	Prey Diversity	Prey Availability	Prey biomass (kg/km ²)	Livestock availability	Livestock intake	Competing predators	Reference
Kruger NP	5	High	246	None	Low	Low	East 1984
Greater Tsavo Ecosystem		Seasonal	Data deficient	High	Low	Medium	East 1984
Selous Game Reserve	14	High	1,874	None	No	Low	Caro et al. 1998 in Hemson 2003
Etosha NP	11	Seasonal	283			Low	Coe et al. 1976; East 1984
Serengeti	13	Seasonal	970	None	None	Low	Hanby et al. 1995
Luangwa Valley	Data deficient	Data deficient	10,003	Data deficient	Data deficient		Ndhlovu & Balakrishnan 1991 in Hemson 2003
Mid - Zambezi	high	High	Data deficient	None	None	Medium	N. Monks pers. comm.
Masai Mara NP	8	High	10,335	Medium	Medium	Medium	Ogutu & Dublin 2002
Ngorongoro Crater	8	High	15,660	None	None		Hanby et al. 1995
Chobe NP	low	High	11,693	Data deficient	Data deficient	Low	Cooper 1991
Hwange NP			30	No	No	High	East 1984
Gir Sanctuary and NP	7	High	2,764	High	High	Low	Khan et al. 1995

Nomadic females are those expelled from their natal territories (Schaller 1972).

Lion grouping strategies

I. Reproductive success:

Reproductive success of individuals of each sex depends on the number of like-sex companions (Packer & Pusey 1987).

Female strategies: Females cooperate to defend their hunting grounds, denning sites and water holes from other prides and at the same time also communally suckle and raise their cubs and jointly protect them from infanticidal males (Packer & Pusey 1997).

Male strategies: Larger coalitions are more likely to gain residence in a pride, remain in residence longer and gain access to more females than small coalitions (Bygott et al. 1979). Group formation thus results in greater reproductive success (Bygott et al. 1979; Packer et al. 1988). Infanticide in lions is another male reproductive strategy whereby males terminate a female's investment in the offspring of other males, which in turn stimulates female sexual receptivity (Hardy 1974; Bertram 1975). Incoming males that take over a pride kill small cubs and oust subadult females below breeding age along with resident subadult males (Pusey & Packer 1983).

Subadult strategies: Although reproductive success increases with group size, individual reproductive success generally becomes lower (Packer et al. 1988). Resident male coalitions are able to successfully raise one cohort during their tenure period (Bygott et al. 1979). In a situation where birth is

synchronous following a takeover, closely-related males are able to strategically disperse together and have the advantage of entering new prides intact (Packer & Pusey 1987). Therefore kinship is essential for the maintenance of larger coalitions, a strategy that would compensate for low individual reproductive success (Packer et al. 1991).

II. Hunting success:

Hunting success is another important factor determining the social structure of lions. Availability of resources such as denning sites, water and a stable, high density resident prey-base supports a high density and stable lion population, with smaller home-range with much less spatial overlap between prides (Scheel & Packer 1995; Ogutu & Dublin 2002; Spong 2002). For instance lion density was 3.3 times higher per km² in Ngorongoro Crater compared to the Serengeti plains, where the availability of prey varied (Scheel & Packer 1995). Hunting success has been shown to increase with increase in group size, especially in hunting down large prey (Stander 1992; Funston et al. 2001). In open areas the hunting success of males is reduced owing to the fact that they are much slower and more conspicuous; therefore by associating with pride females throughout their tenure they can appropriate prey kills (Bertram 1979). In closed areas, however, males can obtain more meat by hunting alone than by scavenging from females (Funston et al. 1998).

Table 4. Details on lion social organization for the lion habitats

Study Area	Population estimate	Home range(km ²)	Density / 100 km ²	Average group size	Male group size	Female group size	M-F interaction (during tenure)	Source
Kruger NP	2,200	150	10.5	11.8	2.1	4.5	Throughout	P.J. Funston pers. comm.
Greater Tsavo Ecosystem	675		Low	8	1	7.4	Throughout	B. Patterson pers. comm.
Selous Game Reserve	3,750	52.4	16	5.3	2.4	3.4	Throughout	Spong 2002
Etosha NP	230	600	2	4.2	1.5	4.8	Throughout	Stander 1992; Oxford et al. 1998
Serengeti	2,500	200	10	11.5	3.1	5.4	Throughout	Hanby et al. 1995
Luangwa valley	49	58	12.7	9.7	2	3.8	Occasional	Yamazaki 1996
Mid - zambezi	120*		5.2	7.7	2	8	Throughout	N. Monks pers. comm.
Masai mara NP	547	71	30	22	2.4	9.2	Throughout	Ogutu & Dublin 2002
Ngorongoro Crater	53	45	40	16.25	3.25	3.5	Throughout	Hanby et al. 1995
Chobe NP	213	1000	5	7	2	7	Occasional	Cooper 1991
Hwange NP	250	Male: 700 Female: 345	3.6		1.9	2.77	Occasional	Loveridge 2005
Gir Sanctuary and NP	360	Male: 85 Female: 35	11		1.4	1.3	Occasional	Meena 2008

* only for Mana pools National Park

III. Tackling competition:

Pride size and lion associations in some areas are determined by the presence of competing species, the Spotted Hyenas (Cooper 1991). Several nomadic lions form aggregates of up to 17 and associate with prides to form stable associations in order to defend against Spotted Hyenas (Cooper 1991).

IV. Prudent strategies for males:

The association of adult male coalitions and female prides may be occasional or throughout the tenure of territorial males and may vary in different areas. In open areas, males associate with the prides throughout their tenure and thus show direct parental investment by providing protection to dependent cubs from infanticidal nomadic males (Kleiman & Malcolm 1981). In closed areas on the other hand, where intruders are less visible, males operate alone and maintain territory by patrolling, scent marking and roaring - a strategy that is effective both in discouraging rivals from entering the pride range and also in ensuring access to more prides (Funston et al. 1998). Pride females in big groups on the other hand, are also able to protect their offspring without the help of pride males (Funston et al. 1998).

Lion social organisation: Observation from the Gir PA

a) Park area, vegetation and cover:

The Gir Wildlife Sanctuary and National Park (Gir PA) is located in the southern part of the Kathiawar peninsula, in the state of Gujarat in western India, extending across districts of Amreli and Junagadh between 21°20'-20°57'N & 70°27'-71°13'E (Figure 2). The Gir PA covers 1412km² area and is part of the greater Gir Conservation Unit about 1800km² in extent. The Gir consist of a series of low hills of volcanic origin with an altitudinal range of 83-524m, while the protected area is surrounded by flat, arid and extensively irrigated agricultural land (Singh & Kamboj 1996). The Gir PA is divided into three management units, namely Sanctuary West (SW), National Park (NP) and Sanctuary East (SE) that vary with respect to rainfall, topography, vegetation and anthropogenic pressures (Khan et al. 1996; Singh and Kamboj 1996).

The Gir has a semi-arid climate with minimum and maximum temperature ranging from 5° to 47°C with an average rainfall of 900mm. Three distinct seasons, namely, summer (March to mid-June), monsoon (mid-June to mid-October) and winter (late October to February) are identified.

The vegetation is tropical dry deciduous forest interspersed with tropical thorn forest (Champion & Seth 1968). The forests of the Gir fall under very dry teak forests (5A/C1a, Champion & Seth 1968). Non-teak forests, namely very dry teak forests and dry savannah forests (types 5/DS1 and 5/DS2) occur in parts of the Gir, and riverine forests occur along the principal rivers and streams (Champion & Seth 1968). Nearly 70% of the total area of Gir (west and central) is covered with teak *Tectona grandis* and its associates while much of eastern part of Gir is dominated by *Anogeissus latifolia*. Coastal border forest, consisting of plantations of *Prosopis juliflora* and *Casuarina equisetifolia* occur along the coastal belts of Una and Kodinar talukas (Singh & Kamboj 1996).

Tree densities (density \pm 95% CI) vary across the park based on terrain and water availability (Khan et al. 1996). On a relative scale, the NP is most dense (301 \pm 53ha⁻¹), SW moderately dense (268 \pm 31ha⁻¹) while SE with an open wooded grassland vegetation has the least density (109 \pm 31ha⁻¹) (Khan et al. 1996)

b) Prey biomass, diversity:

The wild prey base available for the larger carnivores is comprised of Chital (*Axis axis*), Sambar (*Rusa unicolor*), Nilgai (*Boselaphus tragocamelus*), Chousingha (*Tetracerus quadricornis*), Chinkara (*Gazella gazella*), Wild Boar (*Sus scrofa*), Porcupine (*Hystrix indica*), Common Langur (*Semnopithecus achates*), Rufous-tailed Hare (*Lepus nigricollis ruficaudata*) and Peafowl (*Pavo cristatus*) (Singh & Kamboj 1996). The prey is residential throughout the year and seasonal variation is minimal (Khan 1996).

An earlier estimate of total prey biomass (wild and domestic) varied in different park areas with 6,380 kg km⁻² for Sanctuary-West, 3,292kg km⁻² for National Park and 10,717 kg km⁻² for Sanctuary-East (Khan 1996). Wild Ungulate densities ranged from 50.8km⁻² to 0.42km⁻², Chital being the most abundant

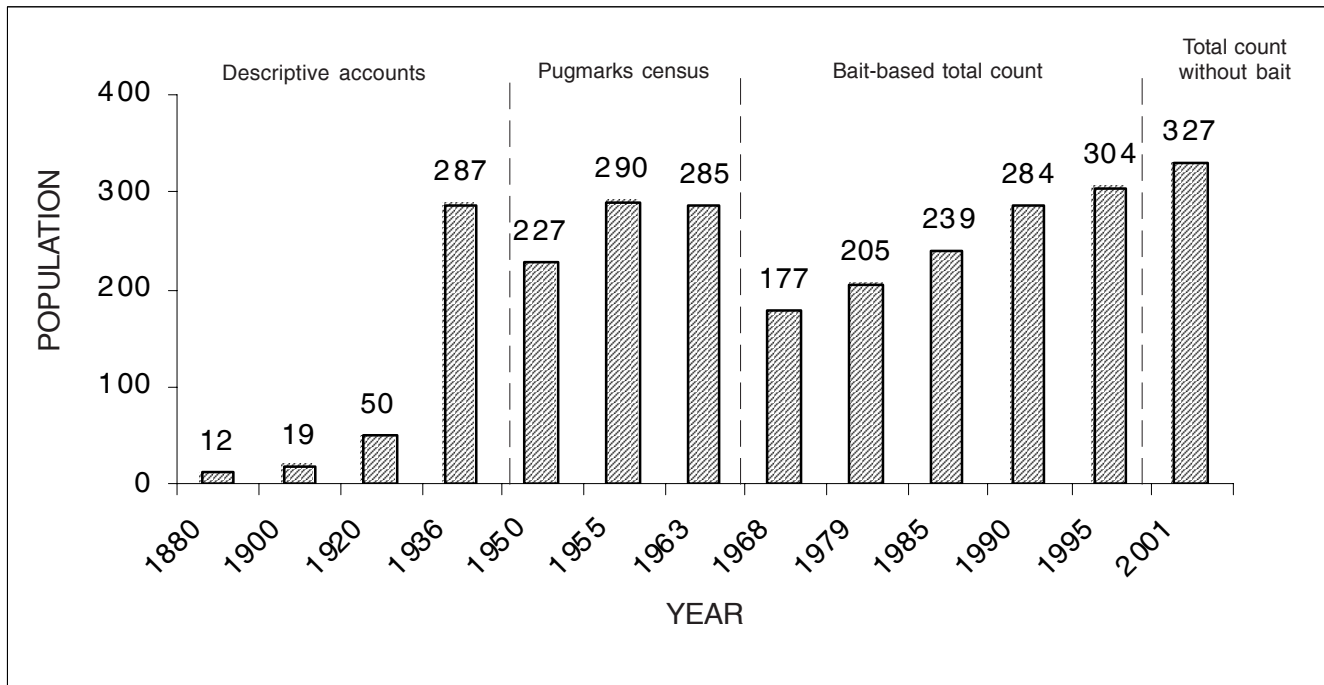


Figure 3. Population fluctuation of Asiatic Lion from the year 1880 to 2001

species (Khan 1996). The recent estimate of the overall density (\pm SE) of all wild Ungulate species of Gir has been estimated at $48.3 (\pm 6.1)$ individual/ km^2 (Dave unpublished). Chital is the most common species with a density of $44.8 (\pm 7.2)$ individual/ km^2 (Dave unpublished). This apparent variation in ungulate biomass across the Gir PA may appear to be the factors responsible for the lion social structure but the above studies have not taken into account the biomass of another important prey-base available to lions, *viz.*, that of the domestic livestock. The livestock densities are highest in Sanctuary-East and probably influencing lions to form larger groups particularly in the vicinity of the cluster of nesses in this area. On the other hand, the principal wild prey, the Chital approximately weighs 45kg and cannot support the feeding requirements of large groups. Hence, the role of prey biomass in influencing lion grouping patterns requires a more detailed understanding of prey availability in different parts of the park.

c) Livestock availability and intake:

Approximately 1,06,916 livestock are present in the peripheral villages and nesses (settlements of local pastoral community within the PA) in and around Gir PA (Pathak et al. 2002). Lions are still largely dependent on livestock as part of their diet, especially in the peripheral areas outside the PA boundaries (Meena 2008).

d) Competing predators:

There is no evidence of direct competition between the three carnivores of Gir, namely Lion, Leopard (*Panthera pardus*) and Hyena (*Hyena hyena*), although a specific study on the topic is yet to be undertaken. Hyenas exist in very low densities and probably do not influence the social behaviour of lions in any way. However, lions have been observed to take over kills from leopards (Meena pers. obs.). The elusive behaviour of

the latter species helps to avoid direct competition with the dominant lions.

e) Population characteristics:

The Asiatic Lion population has fluctuated widely in the past and in recent years has shown a steady increase (Fig. 3). According to the Gujarat Forest Department census, a total of 360 lions occur in Gir at an average density of 10 lions/ 100 km^2 (Meena et al. 2007). Males and females associate only during mating and do not rest or feed together. Male groups range from 1 to 3 while female prides range from 1 to 4 and mean group sizes (\pm SD) are 1.4 ± 0.50 ($n=283$) and 1.3 ± 0.53 ($n=291$), respectively (Meena et al. 2007). Mean male ranges and core areas were larger $85 \text{ km}^2 (\pm 54 \text{ SD})$ and $10 \text{ km}^2 (\pm 3.9 \text{ SD})$ respectively than females being $35 \text{ km}^2 (\pm 7 \text{ SD})$ and $5 \text{ km}^2 (\pm 1.7 \text{ SD})$. Males tend to disperse at different social phases and therefore use a much larger range (Meena 2008).

The habitat of Gir, as described earlier, is relatively denser than the open plains of the Serengeti thereby providing equal opportunities for hunting success for males and females as described in other comparable African Lion habitats such as Kruger National Park (Funston et al. 2001). The diet constituting both small and medium wild prey as well as a vulnerable livestock prey-base, are responsible for low lion group sizes and the loose bonding between male and female groups – a strategy that also increases the reproductive success of male lions. The increasing lion population and density promote smaller group sizes and greater range overlaps among Gir lions given that in the past, larger prides have been reported (Joslin 1973; Chellam 1993). However, the role of genetically closely related individuals, if at all, in driving resource-use is yet unexplored.

Thus, stable prey availability, hunting success, closed canopy (compared to open plains that lions largely inhabit), minimal competition between top predators are responsible for the

described patterns of social organization of the Asiatic Lions.

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