

# Mating Systems of Lemurs

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## Abstract

Lemurs, a unique primate lineage exclusive to Madagascar, display mating systems encountered across primates and mammals alike, ranging from polygynandrous mating to polygyny and monogamy. However, lemurs demonstrate many unique characteristics which differentiate them from non-Malagasy primates. These include female dominance, a lack of sexual dimorphism, a preponderance of monogamous species, strict breeding seasons, high infant mortality, and sperm competition alongside male-male competition. These and other idiosyncratic traits have been termed the “lemur syndrome” and are believed to have arisen in response to Madagascar’s harsh and unpredictable environment. These traits, as well as examples of lemur species mating systems, are discussed herein.

## Keywords

Allomaternal care; Dominance; Lemur; Lemur syndrome; Mating system; Monogamy; Scramble competition; Sexual dimorphism; Sperm competition

## Lemurs of Madagascar

The island of Madagascar, located east of the Mozambique Channel, is a global biodiversity hotspot known for its high rates of species endemism. Malagasy primates, or lemurs, are found exclusively in Madagascar and have experienced a long history of evolutionary isolation believed to have begun via rafting events from continental Africa 50–65 million years ago. Lemurs are Strepsirrhines, primates like Africa’s galagos and pottos and Asia’s lorises, which are distinct from monkeys and apes. Over 100 species of extant lemur are found in Madagascar, a radiation composed of five families—Cheirogaleidae, Lepilemuridae, Lemuridae, Indriidae, and Daubentoniidae—and fifteen genera (Table 1). Madagascar additionally hosted more than fifteen now-extinct giant subfossil lemurs, each larger than all living species, and weighing up to 200 kg; some species remained as recently as 500 years ago and are believed to have been extirpated in a mass extinction event triggered by the arrival of humans to the island (Godfrey *et al.*, 2010). Lemurs continue to be at risk: 90% of species listed by the IUCN Red List are threatened with extinction (IUCN, 2017), earning lemurs the undesirable moniker of the world’s most endangered mammals.

**Table 1** Reported mating system for lemur species organized by Family, Genus, and common name

Family	Genus	Common name	Mating system
Cheirogaleidae	<i>Allocebus</i>	Hairy-Eared Dwarf Lemurs	Polygynandrous <sup>*</sup> ; Monogamous <sup>a</sup>
	<i>Cheirogaleus</i>	Dwarf Lemurs	Monogamous
	<i>Microcebus</i>	Mouse Lemurs	Polygynandrous <sup>*</sup>
	<i>Mirza</i>	Giant Mouse Lemurs	Polygynandrous <sup>*</sup>
	<i>Phaner</i>	Fork-Marked Lemurs	Monogamous
Lepilemuridae	<i>Lepilemur</i>	Sportive Lemurs	Monogamous
Lemuridae	<i>Eulemur</i>	True Lemurs	Polygynandrous; Monogamous <sup>b</sup>
	<i>Hapalemur</i>	Bamboo or Gentle Lemurs	Polygynous; Monogamous
	<i>Lemur</i>	Ring-tailed Lemur	Polygynandrous
	<i>Prolemur</i>	Greater Bamboo Lemur	Polygynandrous
Indriidae	<i>Varecia</i>	Ruffed Lemurs	Polygynandrous
	<i>Avahi</i>	Woolly Lemurs	Monogamous
	<i>Indri</i>	Indri	Monogamous
Daubentoniidae	<i>Propithecus</i>	Sifakas	Polygynandrous
	<i>Daubentonia</i>	Aye-aye	Polygynandrous <sup>*</sup>

<sup>\*</sup>Genus displays scramble competition mating which may result in polygynandrous, polygynous, or polyandrous mating depending on local conditions.

<sup>a</sup>Presence of either polygynandrous or monogamous mating systems proposed by Biebow (2009) but is unresolved.

<sup>b</sup>*Eulemur mongoz* and *Eulemur rubriventer* are the only two generally-monogamous species of the genus.

## Consequences of Madagascar's Harsh Environment

Madagascar constitutes a natural experiment in evolutionary isolation. When Madagascar's first primates arrived on the island, many common competitors, like large mammals, were absent, allowing lemurs to diversify and fill unclaimed niches. However, Madagascar was and remains not without its challenges. Perpetually poor soil has led to lower plant, and thus food, productivity than that found in other primate locales (Ganzhorn *et al.*, 1999). Food availability is additionally highly seasonal; Madagascar has annual wet and dry seasons, the latter of which is associated with substantially decreased food availability. Resources are further threatened by Madagascar's susceptibility to extreme weather events. Its placement in the Indian Ocean makes Madagascar vulnerable to frequent cyclones and tropical storms, causing landslides, floods, and loss of foliage as well as felling trees. All of these factors drive low and irregular food availability, placing lemurs in an unpredictable environment which likely has shaped the prevalence of lemurs' many unusual characteristics.

### The Lemur Syndrome

Many lemurs exhibit a suite of traits belonging to the "lemur syndrome," traits which largely differentiate them from all other primates. Wright (1999) assembled the following features within this classification: (1) female dominance, (2) targeted female-female aggression, (3) lack of sexual dimorphism across mating systems, (4) preponderance of monogamy, (5) sperm competition alongside male-male aggression, (6) high infant mortality, (7) presence of cathemerality, (8) low metabolic rate, and (9) strict breeding seasons dictated by photoperiods. A number of these directly relate to and impact lemur mating systems.

Wright's (1999) energy frugality hypothesis asserts that these traits demonstrate adaptations to either conserve energy or maximize use of scarce resources, a response to Madagascar's harsh and unpredictable climatic conditions. Despite the majority of lemurs showing no sexual dimorphism (Glander *et al.*, 1992), female lemurs are typically dominant in their groups (Richard and Nicoll, 1987), winning in aggressive interactions with males and taking feeding priority. As reproduction—from cycling and gestation to lactation and infant care—is costlier for females, female lemurs must take feeding priority in an environment where access to resources is not consistent (Young *et al.*, 1990). Indeed, (Baden *et al.*, 2013) found that female black-and-white ruffed lemurs (*Varecia variegata*) reproduced only once out of six available annual cycles during their study, a result attributed to lower available resources over the period. This emphasizes how resource availability can drastically affect fecundity, particularly in Madagascar.

A distinct birthing season is rare in primates but ubiquitous in lemurs (Janson and Verdolin, 2005). The photoperiodicity, or daily sunlight, of Madagascar's distinct annual dry and wet seasons drives reproductive seasonality; this trigger is so strong that even captive lemurs transported to different latitudes adjust their mating season to the light levels of their new environment (Rasmussen, 1985). Breeding and gestation across lemurs is restricted to the dry season (roughly March–July), while birth and lactation occur during the wet months (August–February), when more food is available and energy needs of a mother are high. During the breeding season, breeding is highly synchronized and limited within species to a roughly two-week window (Wright, 1999). Individual female receptivity is even more concentrated: females are in estrus for 4–32 h, and in all cheirogaleids, the aye-aye, and ruffed lemurs the vaginal opening is sealed outside of the female's estrus period (Wright, 1999). Male testicular development tracks female receptivity as well, reducing in size outside of the breeding season (Glander *et al.*, 1992). Lemurs have an excellent olfactory system through which females may indicate their estrus period. Females may also advertise sexual readiness via labial swelling and reddening, as in the *Propithecus*, *Eulemur*, *Lemur*, and *Varecia* genera.

Exceptions to lemurs' strict reproductive seasonality may occur however, as the Northern giant mouse lemur (*Mirza zaza*) is believed to be able to breed seasonally (Rode-Margono *et al.*, 2015); future research is warranted to determine the extent to which other lemur species may breed outside of their traditional window. Nevertheless, Tecot (2010) reported 100% infant mortality for red-bellied lemur (*Eulemur rubriventer*) infants born outside of the species' late-August–October birth peak, indicating that a wider birth season is maladaptive. Births occurring outside of a species' birth peak in Madagascar may thus result in lactation and weaning during periods of food scarcity, reducing the likelihood of infant survival.

Infant mortality in general in lemurs is also higher than that of other primate groups (40%–80%; see summary in Wright, 1999). Large-bodied lemurs, like sifakas (*Propithecus*) and brown lemurs (*Eulemur*), typically give birth to singletons every 2–3 years whereas small-bodied lemurs, like mouse lemurs (*Microcebus*) and dwarf lemurs (*Cheirogaleus*), usually birth annual litters of 2–3 offspring, the latter a pattern similar to small non-primate mammals (Wright, 1999). Ruffed lemurs (*Varecia*) constitute an exception: although a large-bodied species, ruffed lemurs also give birth to litters of 2–3 infants. The added maternal reproductive costs of additional offspring are offset by an unusual infant care system involving crèching, or nesting, of young in communal nests as well as communal care, whereby individuals of all age-sex classes in a group participate in guarding, carrying, and even allonursing group infants (Baden *et al.*, 2013). Thus, lemur mothers offset the risk of infant mortality with a variety of strategies, such as wider inter-birth intervals, to expend more energy on single offspring, large litters, or the presence of communal care.

### Mating System Terminology

When defining a species mating system it is important to use the proper terminology. In the literature, terms are often used inappropriately, masking the author's true intent: pair-living or pair-bonded, for example, may be used interchangeably to describe a species' mating system when the appropriate terminology is that they are monogamous (Tecot *et al.*, 2016). In this example,

pair-living and pair-bonded do not indicate that partners exclusively mate with one another, only that they live in a shared home range and maintain long-term stable associations. Thus, a species in a 'pair-bonded' mating system could be read as one synonymous with monogamy or one that mates with multiple partners: the terminology is unclear.

Kappeler and van Schaik (2002) address the need for precise, consistent, and distinct terms when describing a population or species' social organization, mating system, and social structure, commonly-conflated and confused concepts among primatologists. A *social organization* describes the composition of adults across sexes within a group, as well as its size, and degree of spatio-temporal cohesion. In terms of its composition, a species, population, or group, may be solitary; pair-living; unimale, multifemale; multimale, unifemale; or multimale, multifemale. A *mating system* can be described as who mates with whom and who sires and gives births to offspring, thus containing both a social and genetic component. Mating can be categorized as monogamous, polygynous, polyandrous, or polygynandrous (see Table 1 for a summary of social organization and mating system terms). Finally, a *social structure* is defined by relationships among group individuals resulting from social interactions.

A hypothetical primate group could thus be described as follows. Its current social organization is multimale, multifemale, consisting of an even sex ratio of 5 males and 5 females, all of whom maintain a consistent grouping interannually. Its mating system is polygynandrous; both males and females mate with multiple partners, but siring is skewed toward a single, central male. Its social structure could be described by a dominance hierarchy and information about agonistic and affiliative interactions between dyads, among other descriptors. Under the definitional system used here, it would be inappropriate to describe this group as possessing either a polygamous or polygynandrous social organization or a multimale, multifemale mating system: to avoid confusion, social organization and mating system terms are not interchangeable under this framework. While this example describes a single primate social group, this definitional system can also be used to describe a species overall: this species may be multimale, multifemale, exhibiting polygynandrous mating and an established dominance hierarchy, for example, and its group composition may be described in more general, or averaged, terms (e.g., 5–15 individuals).

Polygynous mating systems may be split into further categories of note (Table 1; Kappeler and van Schaik, 2002). Spatial polygyny occurs when a single male in a solitary species defends a territory containing multiple females, to which he has exclusive mating access. Scramble competition polygyny arises when a male ranges broadly, mating with multiple females. Scramble competition polygynandry could also easily occur under a similar scenario, whereby individual females mate with multiple roaming males. Thus, a single species may display either scramble competition polygyny or polygynandry based on the degree to which females are accessible, both by a single male and by a community of males, despite males pursuing the same strategy—accessing multiple females—in each. Finally, harem polygyny is perhaps polygyny's most commonly-envisioned form: one male monopolizing mating opportunities with females that are within the same social group.

## Monogamy in Lemurs

True monogamy is rare in mammals, accounting for 9% of species (Lukas and Clutton-Brock, 2013), yet it is more common among lemurs, occurring in eight of the fifteen extant genera (Table 1). Monogamous lemurs may occur in dispersed pairs, whereby adult males and females merely share an exclusive home range and do not encounter one another frequently (e.g., *Phaner*, *Lepilemur*) or within a pair-living social organization, where individuals display tight cohesion and high rates of affiliative interactions (*Eulemur*, *Hapalemur*, *Indri*). Regardless of the social organization where monogamous mating takes place, the preponderance of monogamous lemur species may make them model candidates for studying the evolution of monogamy (Wright, 1999): monogamy's related social organization, pair-living, evolved from group-living species at least twice in Lemuridae alone, in *Eulemur* and *Hapalemur* (Kappeler and Fichtel, 2016).

Many hypotheses have been put forth regarding the evolution of monogamous mating, some of which could be more accurately described as explaining pair-living or pair-bonded systems. Those predominant among them include the optimal group size hypothesis, infant care hypothesis, infanticide prevention hypothesis, mate defense hypothesis, and resource defense hypothesis (see summaries in Tecot et al., 2016). Those most commonly evoked for lemurs include mate defense and resource defense. Male red-tailed sportive lemurs (*Lepilemur ruficaudatus*), for example, who live in dispersed pairs, are thought to employ a mate defense strategy. Males are responsible for maintaining proximity to their paired female and defend their territory only against intruding males, particularly increasing movement during the breeding period (Hilgartner et al., 2012). Monogamy in this species may be a means for males to secure a female during her short mating period when resource scarcity in Madagascar increases the spacing of females (Wright, 1999) to the extent that monopolization of multiple females is not possible. In contrast, red-bellied lemurs (*Eulemur rubriventer*) are thought to be monogamous under a resource defense strategy (Tecot et al., 2016). Adult male and female red-bellied lemurs jointly defend territories that demonstrate minimal overlap with other groups. Ranging is additionally observed to vary with fruiting schedules of individual trees, and between-group agonism increases during periods of food scarcity, underscoring the importance of defending limited resources (Tecot et al., 2016). Thus, pair-living in this species may arise as a means of defending small patches of limited resources which may be shared across two partners, resulting in a monogamous mating system.

Lemur's strict reproductive seasonality likely does not make them likely models for pair-living as an evolved means of protecting against infanticide (Kappeler and Fichtel, 2016). If an infanticidal male killed a female's offspring, he would gain no reproductive advantage until her next annual cycle. Outside of pair-living groups, many lemur females also mate with multiple males and are thus non-monopolizable: an infanticidal male would still need to compete with other group males for reproductive access.

Nevertheless, infanticide has been known to occur in some lemur species, especially in those that do not have infants every year (e.g., Milne-Edwards sifaka: [Wright, 1999](#)), and even in monogamous species, like red-bellied lemurs (infant disappearance following adult takeover: [Jacobs et al., 2018](#)).

### Extra-Pair Copulations and Genetic Monogamy

An important distinction needs to be made between monogamy and the more precise genetic monogamy. While monogamous species may be characterized by exclusive mating between partners, extra-pair copulations (EPCs) can occur outside of a pair; the degree to which this happens is difficult to quantify by observations alone. Genetic analyses can thus help to elucidate the extent to which populations of 'monogamous' species reproduce outside of their partnership. The fat-tailed dwarf lemur (*Cheirogaleus medius*) provides one such example: 44% of *C. medius* offspring were found by [Fietz et al. \(2000\)](#) to be extra-pair young, conceived through an EPC. Nevertheless, the species displays extensive biparental care, with both sexes babysitting and guarding young. [Fietz and Dausmann \(2003\)](#) further suggest that indiscriminate care to young may still provide an advantage to males in a pair: caring could increase the likelihood of further reproduction or could provide benefits through kin selection if the extra-pair young were fathered by a close relative. Similarly, the Masoala fork-marked lemur (*Phaner furcifer*) revealed a high rate of extra-pair young from offspring examined via paternity exclusion analyses, and females were observed to travel longer distances during the mating season, suggesting that they may be in search of EPCs ([Schülke et al., 2004](#)). [Jacobs et al., \(2018\)](#) likewise found that 25% of red-bellied lemur (*Eulemur rubriventer*) groups in Ranomafana National Park were not characterized as nuclear family groups, with some groups having two adult females present and others with an adult male who was not the father of the group's offspring. They note the complexity through which such situations arise; while they believe EPCs do occur in the species, albeit at a very low rate, non-nuclear family group compositions were also known to have arisen through at least one adult turnover following forcible eviction of the group's adult male by another and could also occur following the death of a resident male or female. Thus, monogamous species may not be universally monogamous in practice, and care must be taken regarding assumptions of paternity within such groups.

### Allomaternal Care

Pair-bonding, or the consistent association of two unrelated individuals of the opposite sex, commonly associated with many monogamous mating systems, may also evolve as the result of the need for biparental care. Infants of pair-bonded species such as bamboo lemurs (*Haplemur*) or pair-bonded brown lemurs (*Eulemur rubriventer* and *E. mongoz*) have been shown to receive care by both adult members of the pair, including travelling, grooming, and huddling by both sexes. However, allomaternal care, even allopaternal care, is more common in lemurs than was originally thought: non-mothers have been reported to help care for infants—via infant transportation, babysitting, and allomaternal nursing—across many lemur genera, including *Cheirogaleus*, *Microcebus*, *Eulemur*, and *Propithecus*, among species that are both pair- and group-living ([Tecot et al., 2013](#)). Thus pair-bonding is not a prerequisite for allomaternal care in lemurs, although further research is needed to quantify its extent.

### Polygyny and Polygynandry in Lemurs

Non-monogamous group-living lemur species display a variety of mating systems ([Table 1](#)), some of which vary within species or even within a group's history ([Pochron and Wright, 2003](#)). Aloatran gentle lemurs (*Haplemur aloatrensis*), for example, appear to occupy a flexible mating system between monogamy and polygyny: intergroup transfer of males commonly occurs, leading to serial monogamy in some groups, while 40% of surveyed groups by [Nievergelt et al., \(2002\)](#) had two breeding females and thus a polygynous mating system. Multiple studies of the red-fronted brown lemur (*Eulemur rufifrons*) also reveal the complex strategies present within a polygynandrous system. While *E. rufifrons* females will typically mate with all resident males, matings are typically concentrated with a central male in each group who also interacts socially with females more than other males do ([Ostner and Kappeler, 1999](#)). Such relationships, while granting the central male increased opportunities for mating, also may provide a benefit to females: female red-fronted lemur feeding rates, and thus potential resource acquisition and associated increased reproductive success, have been shown to be higher when feeding with male partners due to the role males play as the predominant aggressors of extragroup competitors ([Overdorff, 1998](#)). Reproductive skew among red-fronted brown lemur males was found to be as high as 71% for dominant males, indicating that dominant males in the species likely do not use a concession model of mating whereby subordinates are permitted limited reproduction opportunities to incentivize group membership ([Kappeler and Port, 2008](#)): instead males compete for reproductive access, with the dominant male commonly achieving the highest reproductive success. Red-fronted brown lemur females also experience intrasexual competition for reproductive success. [Kappeler and Fichtel \(2012\)](#) found that females in larger groups (>10 individuals) were both more likely to be evicted by group females and less likely to reproduce than females in smaller groups, indicating some form of either reproductive restraint or suppression by females despite belonging to the same matriline. Reproductive opportunities for evicted females in the species were limited: out of 22 evicted females, two were known to have successfully reproduced, and the majority of the remaining disappeared from the study area ([Kappeler and Fichtel, 2012](#)).

While a female in species like *E. rufifrons* will copulate over multiple days before and after her likely receptive period, sifaka females (*Propithecus*) copulate one day per year, so that receptive days across group females are often asynchronous (Milne-

Edwards sifaka: Pochron and Wright, 2003). This asynchrony is thought to increase male-male competition over individual females so that she may gain information regarding mate choice. Sifaka males exhibit chest staining via a sternal gland regulated by testosterone: stained males in Verreaux's sifaka (*Propithecus verreauxi*), for example, have higher levels of testosterone than clean-chested males (Lewis, 2009), indicating staining as a potential honest signal used to influence female choice or advertise competitive ability. A study by Kappeler and Schäffler (2008) found that many Verreaux's sifaka groups effectively functioned as harem, or polygynous, groups due to extremely high reproductive skew (91%) in favor of the groups' dominant male. Such a skew defies expectations of the lemur syndrome, as multimale, multifemale lemur groups tend to have a roughly equal sex ratio where monopolizability of females would be difficult. Further research would be useful in determining what factors drive reproductive skew and the presence of polygyny and polygynandry in group-living lemurs.

### Scramble Competition

Many of Madagascar's nocturnal lemurs lead a generally solitary lifestyle and practice polygynandrous, or promiscuous, mating (Table 1; Table 2) through a system of scramble competition. Scramble competition results when the ability to monopolize females is relatively low, and males will range widely in home ranges overlapping with multiple females in an attempt to access as many mating opportunities as possible, an especially demanding task during lemur species' relatively short annual reproductive windows. Both females and males will mate with multiple partners during a female's estrus period, although scramble competition within a single population may vacillate between polygynandrous, polygynous, or polyandrous mating systems depending on the spatial configuration and availability of neighboring partners.

Scramble competition in lemurs has perhaps best been studied in both wild and captive grey mouse lemurs (*Microcebus murinus*). An extensive study by Eberle and Kappeler (2004) examined grey mouse lemur mating tactics and reproductive success by combining genetic analyses with behavioral observations to determine the extent to which *M. murinus* could be described as having scramble or contest competition. Females proved difficult to monopolize due to a high degree of range overlap between individuals. However, males were able to visit the centers of activity for 4–21 females during the mating period; further, females were visited by between 2 and 15 males. Mate guarding of females did occur by males, evidencing some contest competition, but did not take place across a female's entire receptive window. A captive study by Andrès and Solignac (2003) additionally found evidence of female choice in grey mouse lemurs: females displayed more aggression to subordinate mouse lemur males, a quality related to competitive abilities detectable in male urine, allowing only competitive males to breed with her. Thus, while scramble competition is often difficult to study in nocturnal species (but, see Kappeler, 1997), many nocturnal lemurs likely use elements of mating strategies like those of the grey mouse lemur.

### Post-Copulatory Competition: Sperm Competition

When females mate with multiple males during a single breeding period, males develop varying strategies to increase the likelihood that their sperm will result in successful insemination. Among lemurs, these include relatively large testes and copulatory plugs. In fact, a lemur displays the largest known relative testes size among primates (*Mirza zaza*: Rode-Margono *et al.*, 2015), providing evidence of the selective pressure of polygynandrous mating on sperm competition in lemurs. Controlled matings of the grey mouse lemur (*Microcebus murinus*) additionally revealed the presence of some litters with more than one father (Eberle *et al.*, 2007). Thus, high relative sperm volume can aid in successfully siring even when a female has already been inseminated. Males may additionally be able to compete with others via physiological suppression of other group mates: dominant Verreaux's sifaka (*Propithecus verreauxi*) males were shown to have higher testosterone levels than their subordinate co-residents, a factor which likely grants

**Table 2** Social organization and mating system terms used in this article. Composition of Individuals refers to the number and composition of adult individuals involved in defining either the related social organization or mating system. Various forms of polygynous mating systems are also listed

Composition of individuals		Social organization term	Mating system term
One individual		Solitary	–
# Males	# Females		
One	One	Pair-living	Monogamous
One	Several	Unimale, multifemale	Polygyny Spatial polygyny Scramble competition polygyny Harem polygyny
Several	One	Multimale, unifemale	Polyandry
Several	Several	Multimale, multifemale	Polygynandry <sup>a</sup>

Note: Modified from Kappeler, P.M., van Schaik, C.P., 2002. Evolution of primate social systems. *International Journal of Primatology* 23, 707–740.

<sup>a</sup>May also be referred to as promiscuous mating or polygamy.

dominant males an advantage in sperm competition (Kraus *et al.*, 1999). In non-monogamous lemurs, sperm competition does not displace male-male aggression as it often does among other primates (Wright, 1999); instead, male lemurs will engage actively with other males in competition for access to mates (Andrés and Solignac, 2003).

Copulatory plugs, or gelatinous excretions which harden within a female's vaginal cavity following ejaculation, are additionally employed by some lemur species (e.g., ring-tailed lemur: Parga, 2003; Northern giant mouse lemur: Rode-Margono *et al.*, 2015), to minimize the loss of sperm by the female and to make it more difficult for subsequent males to successfully mate. Copulatory plugs may be removed via penile displacement by competing males during some copulations (e.g., 41%, Parga, 2003). Females may also attempt to remove copulatory plugs. However, female grey mouse lemurs (*Microcebus murinus*) were observed to need two or more days to remove copulatory plugs on her own, a period longer than her receptivity window (Eberle *et al.*, 2007) and thus an effective counter-strategy by males.

## In Summary

The lemurs of Madagascar demonstrate mating systems as variable as the group itself, perhaps due to a suite of characteristics shared by many lemurs—termed the lemur syndrome—that serve as an evolutionary response to Madagascar's harsh and unpredictable environment. Lemurs display relative sexual monomorphism, in contrast to many other primates, and commonly express female dominance, a mechanism whereby females may consistently receive feeding priority necessary for reproductive success. High infant mortality has resulted in some lemur species having larger litter sizes than is commonly found in primates and the practice of allo-maternal care across some species. Monogamy is also more common among lemurs than across other primates, a potential response both to diffuse spacing of females and the need to jointly defend resources with a partner. Beyond monogamous groups, lemurs engage in both polygynous and promiscuous mating, the latter being associated not only with group-living primates but in nocturnal solitary lemurs engaged in scramble competition. As many lemur species may possess cryptic or flexible mating strategies, further research is needed to characterize the degree of variability in the mating systems of lemurs, particularly as genetic results can provide further information regarding reproductive success.

**See also: Hormones and Behavior:** Female Sexual Behavior and Hormones in Mammals. **Reproductive Behavior:** Mating Systems in Mammals.

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