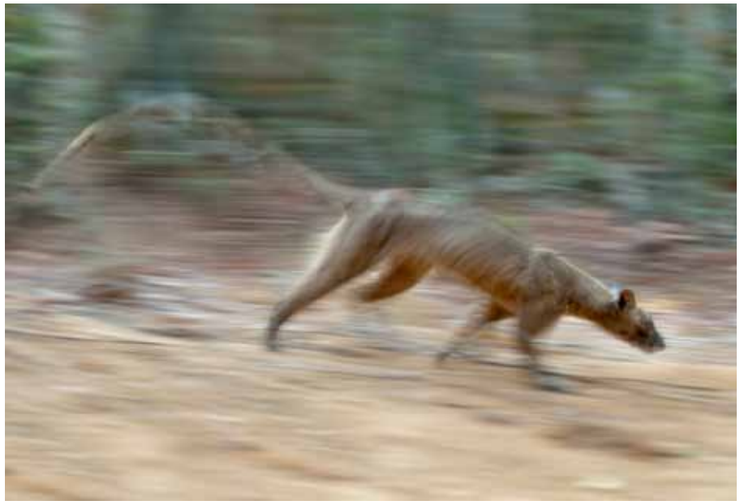
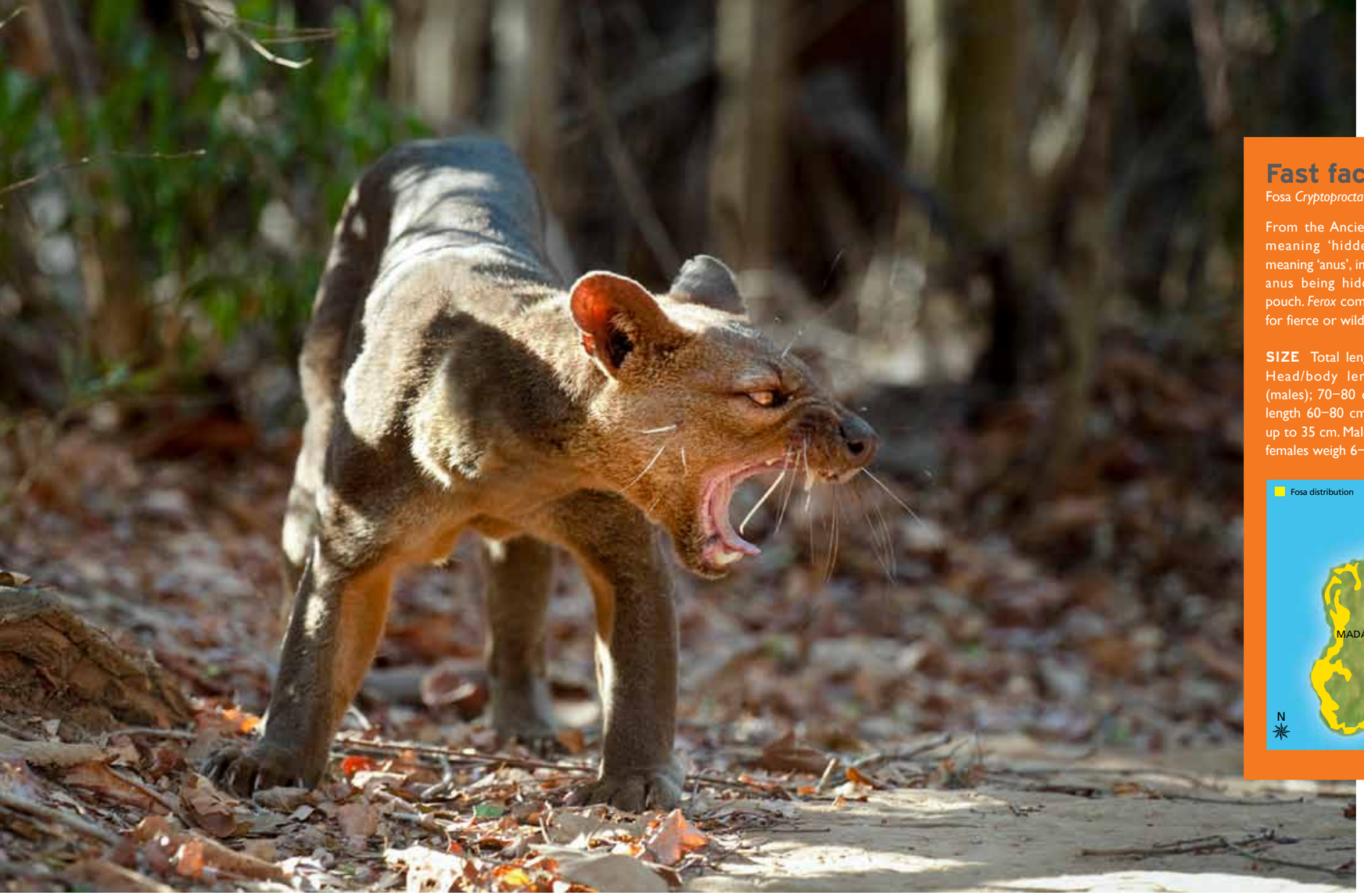
Madagascar's 'FALSE FELINE'

The fosa (pronounced 'foo-sah') may be Madagascar's largest predator, but the species' solitary habits and forest habitats have made studying it closely something of a challenge. Until, that is, this unique carnivore enters its (very) vocal mating season or decides to raid a research camp for malaria pills and leather boots. Seasoned Madagascar buff **Nick Garbutt** reports on scientist **Mia-Lana Lührs**'s latest findings.

TEXT BY NICK GARBUTT & MIA-LANA LÜHRS
PHOTOGRAPHS BY NICK GARBUTT





Fast facts

Fosa *Cryptoprocta ferox*

From the Ancient Greek *crypto*, meaning 'hidden', and *procta*, meaning 'anus', in reference to the anus being hidden by the anal pouch. *Ferox* comes from the Latin for fierce or wild.

SIZE Total length 140–170 cm. Head/body length 65–85 cm (males); 70–80 cm (females). Tail length 60–80 cm; shoulder height up to 35 cm. Males weigh 6–11 kg; females weigh 6–9 kg.

DISTRIBUTION Endemic to Madagascar.

HABITAT Widely but sparsely, distributed throughout native forest regions (mainly rainforest and drier deciduous forest) from sea level to 2 600 metres. Population densities are historically very low – 0.26 individuals per square kilometre in dry forests, probably even lower in rainforests. Density in recent times has probably increased due to habitat loss and 'crowding' in small forest fragments.

DIET Mainly mammals, especially lemurs, but also rodents and tenrecs and other vertebrates. The fosa uses its front paws to pin down larger prey before delivering the fatal bite to its throat or back of head.

BEHAVIOUR Active both day and night (cathemeral). Occupies huge home ranges: in western forests, males cover 110 square kilometres; females range up to 25 square kilometres. Female ranges are exclusive, but those of males overlap considerably and are subject to seasonal fluctuation. Ter-ritorial boundaries are marked with a pungent scent.

COURTSHIP Takes place between mid-October and the end of November. Gestation lasts six to eight weeks, after which between one and three young are born (six have been recorded by Zoo Duisburg in Germany). Females raise offspring alone and usually den in a hollow tree or termite mound. Infants stay with their mothers for 12 months or more, so females can breed only every second to third year. In captivity, their reported lifespan is 23 years (Zoo Duisburg); in the wild it is 18.

Fosas are adapted to an arbor-eal lifestyle: the long tail acts as counterbalance when climbing (but is not prehensile), the paw pads ex-tend almost to the heel, the claws are decurved and semi-retractile and they have 'reversible' ankles. When walking, the foas's gait is distinctive and can be either plantigrade (with the sole of the foot on the ground) or digitigrade (on its toes).

STATUS Vulnerable (likely underestimated due to data deficiency).

Olor a ent occus dolorentur?
Ollissin niet quiaes alis as corro il est, sum fuga. Et fugit la aut dolo ma corehen dandes dolo blaboreres aspedi conem.

Ut officiducil estiorunt provit parchicil mollisq uiasit is est, in num iussitati con consere puditib

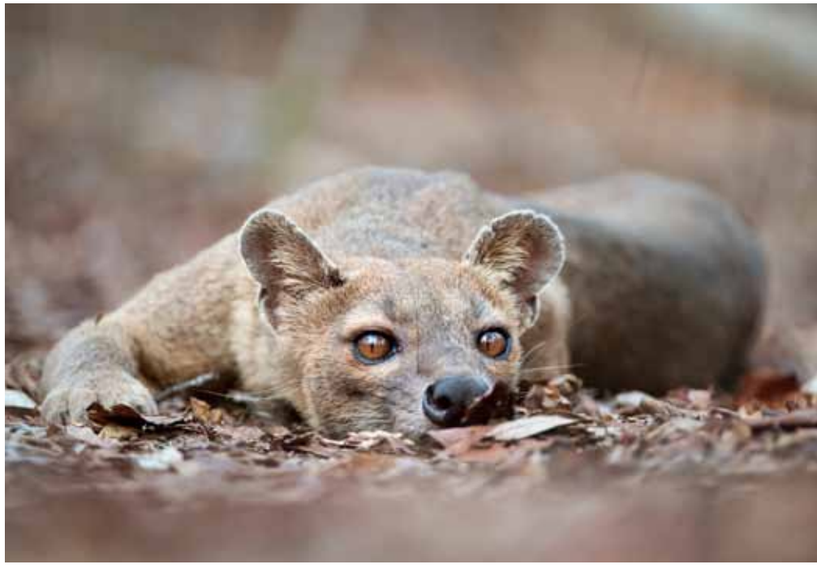
ad quam, con est imus que non et ipid quatur reribuscias et mintore icabor sed ut acepel isimpor aspic to ommoluptin pore parchic iaectis ent alit haribus alibus sintesto mod maio vent odi incit la quassint quoditat

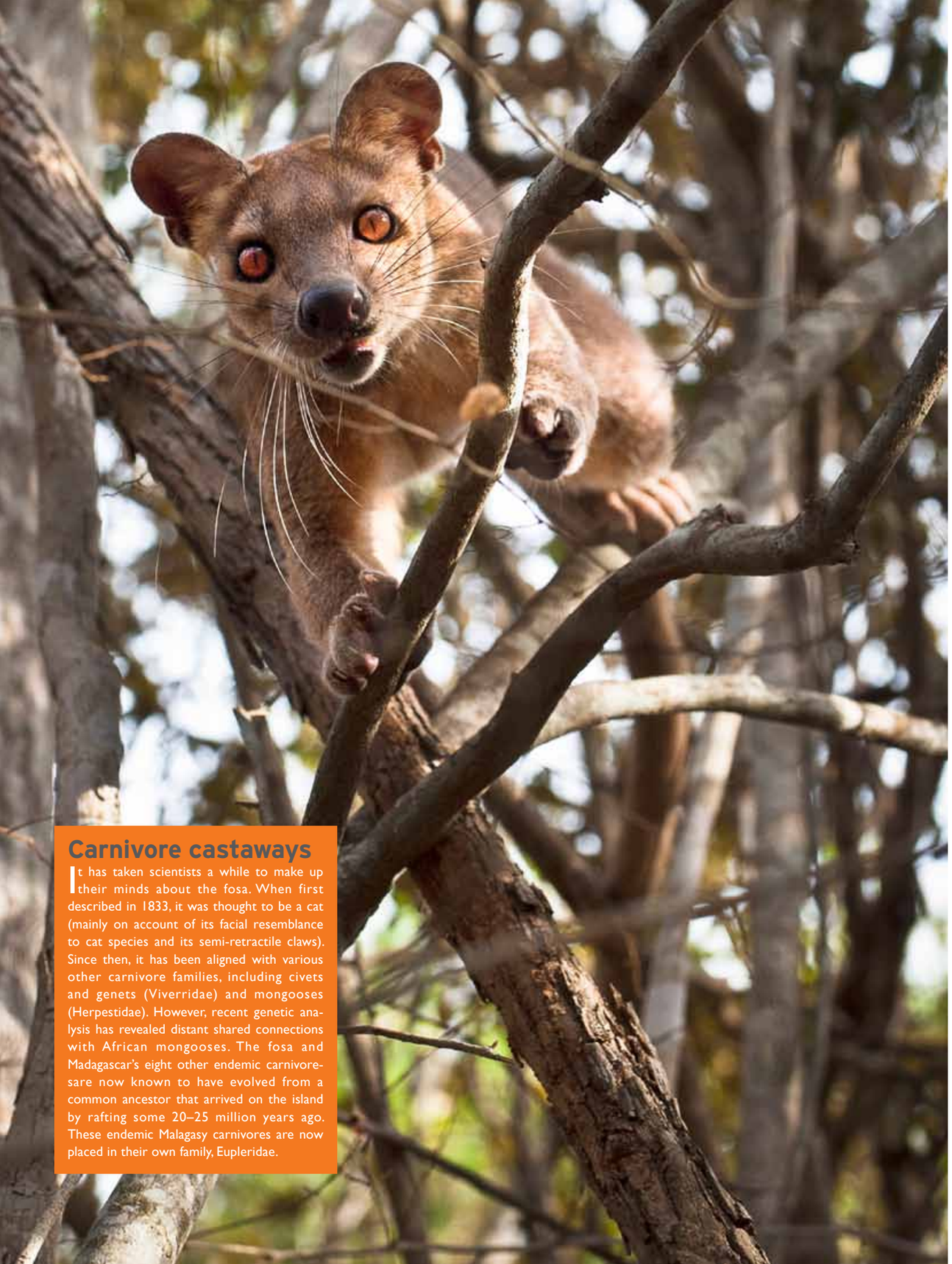
I'm sure we all remember falling in love for the first time – who, when, where – in crystalline detail. Such pivotal events are never forgotten. But how many of us could say it happened in a toilet? (Please don't worry, this isn't about to get weird or perverted.)

Yet this is exactly what happened to Mia-Lana Lührs from the University of Göttingen in Germany. Lührs was in Kirindy Mitea National Park in western Madagascar studying mouse lemurs. One evening when visiting the camp long-drop, she was startled by something crashing through the forest. There was so much noise she expected to see a large animal, but to her surprise, a rather small fosa appeared. Lührs recounts, 'I didn't dare move in case I scared it away, but the fosa was more interested in the smelly toilet than me. Then it came over and sniffed my trousers and bit my leg. It was love at first sight, and I just knew this was the animal I wanted to study.' The scientist later reckoned it had been the smell of mouse lemurs (a favoured prey) on her trousers that had prompted the fosa's odd behaviour.

Some of my own encounters with the fosa have been similarly peculiar. One of the first happened in Kirindy too (several years prior to Lührs starting her work). I was camping and was awakened by loud scratching and scrabbling outside my tent. I unzipped the flap and poked my head out into the cool forest air. Within touching distance was one of my boots – inside the mouth of a fosa. The boot was shredded in 30 seconds and the fosa then ate some of the leather. We stared at one another. I wasn't sure what to do – retreat into my tent or try to scare it away? I admit to being a touch apprehensive, as the animal's powerful jaws and large teeth were blatantly on display. Unlike me, the fosa seemed totally unfazed and after the brief stand-off it turned and padded back into the forest, leaving me rather bemused and minus suitable footwear.

Such antics are in keeping with the species' reputation for erratic and inexplicable behaviour. Fosas have been known to curl up on the embers of campfires, ransack unoccupied tents and eat bars ▸





Carnivore castaways

It has taken scientists a while to make up their minds about the fosa. When first described in 1833, it was thought to be a cat (mainly on account of its facial resemblance to cat species and its semi-retractile claws). Since then, it has been aligned with various other carnivore families, including civets and genets (Viverridae) and mongooses (Herpestidae). However, recent genetic analysis has revealed distant shared connections with African mongooses. The fosa and Madagascar's eight other endemic carnivore-sare now known to have evolved from a common ancestor that arrived on the island by rafting some 20–25 million years ago. These endemic Malagasy carnivores are now placed in their own family, Eupleridae.

of soap and malaria pills as well as boot leather. Most sightings occur during the breeding season, when the animals are more active by day and shed their inhibitions. The fosa's renown as Madagascar's top predator has imbued if with a fearsome reputation (the animated feature film *Madagascar* portrayed fosas as crazed, maniacal killers), yet details of the species' habits and behaviour remain largely unknown. In the 15 or so years since my eye-to-eye encounter, I've seen fosas on many occasions, but most have been glimpses that left my curiosity unsatisfied and many questions unanswered. Like numerous species in Madagascar, the animal seems an enigma.

Even the fosa's striking appearance – a lithe, low-slung, muscular body with a very long, narrow tail – confuses and confounds. It's rather like the feeling you get when you see a person who is vaguely familiar, but you just can't place. With the fosa, there are suggestions of cat, hints of mongoose and insinuations of civet or even dog, yet none of these really fits. So what exactly is a fosa?

The fosa is Madagascar's largest carnivore – in essence a giant mongoose in cat's clothing. Fosas share a distant ancestry with African mongooses (see 'Carnivore castaways'), but in Madagascar have become arboreal hunters *par excellence*. Along the way they have acquired a number of cat-like traits by way of convergent evolution. They are extremely agile climbers, helped by powerful forelimbs, paws with retractable claws and, one of their most peculiar features, 'reversible' ankles. These enable them to grasp both sides of a tree trunk with their hind feet when ascending or descending headfirst.

However, other than sorting out the species' evolutionary affinities, the scient-ific community has largely skirted around the fosa: not surprisingly, as solitary forest carnivores are notoriously difficult to study. Initial research by Clare Hawkins from Aberdeen University, UK, laid the foundations but, more recently, it is Mia-Lana Lührs's work that has produced some remarkable discoveries that are casting the animal in a new light. For instance her GPS tracking data has shown that males range over 100 square kilometres and females cover up to 25 square kilometres.

Lührs has notched up more than 500 hours in the company of fosas, much of this time during the breeding season, recording some of the species' most intriguing behaviour. Courtship occurs from October to November. Receptive females remain at a specific mating tree, where several males aggregate over time. Receptivity lasts for about a week with a single female mating with several different males.

So what do females look for when choosing a mating tree? Earlier research suggested that height is one factor as is proximity to water. While females don't necessarily select the tallest trees, they certainly choose ones with a good vantage. And whatever the 'magic ingredients' are, Lührs's work has shown that these may be recognised by several females, as the same tree and even the same branch within a tree may be chosen simultaneously by a number of females.

She also concludes that love in the treetops conveys two important advantages for females. From a lofty perch their calls carry far and wide to attract the largest number of potential suitors. And, when ▸

Olor a ent occus dolorentur?
Ollissin niet quiaes alis as corro il est, sum fuga. Et fugit la aut dolo ma corehen dandes dolo blaboreres aspedi conem.

Ut officiducil estiorunt provit parchicil mollisq uiasit is est, in num iussitati con consere puditib

Conflicts and conservation

The naturally low densities of fosas in combination with habitat loss and severe fragmentation make the species incredibly vulnerable. But recent work suggests the situation is more complex and the species' plight is far worse than was previously thought. Fosas may already be extremely endangered and heading rapidly towards extinction. The latest Global Mammal Assessment estimates suggest the total population on the island is less than 2 500. Mia-Lana Lührs's population estimate for the greater Kirindy area (considered a species' stronghold) is 100 animals at best and perhaps as few as 30 or even less.

Fosas have always had a bad reputation among local people, either because of traditional beliefs and taboos or the animals' direct predation of livestock, especially chickens. Elsewhere in Madagascar there are other problems. In the Makira forests in the north-east, research by Harvard University fellow Chris Golden has shown that fosas are directly hunted for both food and for body parts that are used in traditional medicine. The species is just one component of a far-reaching local bushmeat trade that includes lemurs (even aye-ayes), carnivores, tenrecs and other mammals

they do arrive, the females can 'control' their advances as only one male at a time can approach her along a branch. If a female doesn't like what she sees, she can move to the thinner branches at the periphery of the canopy, where the heavier males can't encroach. But not all males get the hint. Some, buoyed by excess testosterone, disregard the fundamentals of gravity and continue their advances, often with predictable consequences.

During her countless vigils, Lührs has seen males tumble to the ground numerous times, often from 20 metres or more. Sometimes, when a male and a female are engaged in a treetop spat, both have fallen. Lührs recounts one especially bizarre instance. 'There was a particularly rowdy encounter in the canopy and a branch cracked. Suddenly the couple and the broken branch came crashing down. Both male and female lay beside me motionless, with the branch on top of them.'

Her first thought was that the animals were dead and she admits shedding a tear. 'Then suddenly the male came to, got his bearings and approached the female who was still lying under the branch. He began tugging at her and then started mating with her! In a flash the female regained consciousness and turned around to attack the male violently, before finally chasing him away. Even more remarkably, the same female then climbed back into the tree and began mating again with another male.'

Fosas are famously promiscuous. During their week of receptivity, females have been known to 'receive' as many as 10 different males (although not all at the same time) and they may mate up to 10 times with each male. Single copulations can last as long as six hours and during the receptive period a female can mate over 50 times and spend up to 40 hours in the act. Such extreme competition has led male fosas to evolve a large penis and produce considerable volumes of semen. And like domestic cats and red foxes, they have sharp penile spines, which may maintain the coital union or induce ovulation.

When copulating both males and females are highly vocal and produce a cacophony of weird, sometimes scary noises. (They can also be rather too 'human-sounding' for comfort.) Female 'control' is a recurring theme during courtship. Surprisingly, despite being half the weight of the males, the females are dominant and use specific vocalisations relating to aggression to reinforce this. A single call from a disgruntled female can cause a male to break his union with her and beat a hasty retreat down the tree. Even more impressive is a female's single blood-curdling yelp that 'can clear a tree crown of males in an instant,' says Lührs. 'They leap from the branches rather than risk climbing down and confronting the female.'

Outside the breeding seasons, it has long been assumed that fosas are solitary. But Lührs' work has shown that males can be social and even co-operate during hunts, although she stresses this is probably limited to brothers and more specifically litter mates. While co-operative hunting has been suggested previously (together with professor of biology Joyce Powzyk, I witnessed it over a decade ago in Mantadia National Park), the details have never been clear until now. On one memorable occasion Lührs witnessed three males working in concert to isolate a single Verreaux's sifaka from its group, then chasing and exhausting it for more than 45 minutes before moving in for the kill.

'The males appeared to have a clear strategy, with each playing a different but clear role. One would move in behind the lemur, another pursued it along the ground and the third would climb into the trees ahead and try to anticipate and intercept its movements. Every so often the fosas would even swap roles.' The *coup de grâce* was swift. 'Two of the fosas climbed a tree near me and, with great speed and agility, shot into the canopy where I listened to their excited vocalisations (possible communication?). They were just out of sight when they caught the sifaka, but I could hear its final throes.' The three fosas then shared the kill, with the dominant individual feeding first.

Teamwork potentially conveys a number of advantages. It increases hunting success and as a result the co-operating individuals grow faster than solitary males. Being larger they subsequently have an edge in male–male competition and gain reciprocal support, as happens in coalitions, between cheetah brothers during fights with rivals. Interestingly, Lührs's theories extend beyond this. She postulates that co-operation may be an evolutionary throwback. 'When fosas evolved, Madagascar was home to an array of much larger prey like giant lemurs. Hunting in co-ordinated units may have been the only way they could be successful.'

Along with all the exciting discoveries, Lührs's work has also revealed the many threats facing the species. Rampant deforestation and habitat fragmentation are issues that face most native species in Madagascar, but the problem is far more acute for fosas as they require such large territories. Even in Kirindy (considered a major fosa stronghold), the forest has shrunk so much that populations are being adversely affected. Territories are becoming more tightly packed, competition for prey between individuals is intensifying, and females are getting scarce.

The species also suffers direct persecution from local people. 'When wild food is harder to find, fosas sometimes enter villages to raid chickens,' she explains, 'but if they're caught, they're killed.' In the past two years, Lührs and her colleague Moritz Rahlfs have recorded 12 deaths at the hands of locals, plus one road kill.

In collaboration with Durrell Wildlife Conservation Trust and Zoo Duisburg, the researchers' efforts are now concentrated on raising awareness about the fosas' plight and working with local communities to try to alleviate conflict and establish the species as an emblem for the Kirindy area. While the problems the species faces bear comparison to those of so many other carnivores around the world, there is no doubt that the species itself is utterly singular.

Olor a ent occus dolorentur?
Ollissin niet quiaes alis as corro il est, sum fuga. Et fugit la aut dolo ma corehen dandes dolo blaboreres aspedi conem.

Ut officiducil estiorunt provit parchicil mollisq uiasit is est, in num iussitati con consere puditib