



Having located a grub in dead wood, an aye-aye speedily chews a hole and winkles out the juicy morsel with its elongated middle finger.

**W**hen I was a child in the mid-1970s I avidly collected WWF World Wildlife Collection cards from Shell garages. There were 16 in the set, so it took me a while to get them all, and the species I coveted the most was on Card No. 1: the aye-aye.

I remember few details about the 3D card itself, other than it said that there were fewer than 50 aye-eyes remaining in the remote forests of Madagascar. In 1966 and 1967 the Malagasy government had translocated nine animals (four males and five females) from capture sites on the mainland to the offshore island of Nosy Mangabe in the north-east, in what was thought to be a last-ditch attempt to

save the species. Over the subsequent years these aye-eyes thrived, but on the mainland they were still believed to be restricted to tiny pockets of lowland rainforest in the north-east, and very close to extinction.

That perception continued for another two decades, until in 1990 Durrell Wildlife Conservation Trust (DWCT; then Jersey Wildlife Preservation Trust) organised a rescue mission to collect animals and begin a captive-breeding programme at Durrell Wildlife Park (formerly Jersey Zoo). The story of the expedition was famously recounted by Gerald Durrell in his last book – *The Aye-aye and I: A Rescue Mission in Madagascar*.

At the time of the expedition I was working on the neighbouring island of Mauritius with another Durrell project to help the endangered Mauritius kestrel, and we naturally received periodic progress reports from Madagascar. Not surprisingly the task proved to be very challenging. “We were expecting aye-eyes to be elusive, but not nearly impossible to find,” says Lee Durrell, Gerald’s widow and honorary ►

Photos by Nick Garbutt

# finger food

**Nick Garbutt** reports on new efforts to unravel the ecology of Madagascar’s aye-aye, the lemur that’s among Earth’s most mysterious mammals.



# AYE-AYE

director of DWCT. “On his first casual night recce one of the senior expedition team saw four or five, gathered for a noisy mating session, but never again were they seen in such numbers. We searched for four weeks, day and night, but with no luck. Finally we were persuaded to host a ceremony in which the local elder, aided by rum and silver, called upon the village ancestors to bless our undertaking. Within a few days six animals had been caught!”

These aye-ayes have done well in captivity and the breeding initiative at DWCT has proved very successful (see box, p85). Indeed two of the original six animals are still alive today, 25 years after their capture.

## PECULIAR PRIMATE

Since its discovery and description in 1788, the aye-aye *Daubentonia madagascariensis* has been the subject of considerable debate and confusion. The animal was first classified as a squirrel-like rodent on the basis of its appearance. The species measures 74–90cm from nose to tail tip, with the tail making up more than half its length, and weighs roughly 2–2.5kg. It was only some 100 years later that it was finally accepted as a primate and lemur.

Indeed genetic analysis indicates that the aye-aye, along with all of the other lemurs, evolved from the same colonising ancestor primate, which rafted onto Madagascar about 55–60 million years ago. There is no question that the aye-aye is the most unusual and distinct offshoot of the lemur evolutionary tree, and it is placed on its own in the family Daubentoniidae. A second species, now extinct, once occurred in the dry regions of south-west Madagascar: the giant aye-aye *D. robusta*.

The aye-aye combines a peculiar amalgamation of morphological features and behavioural traits that set it apart. As with rodents, the front teeth (incisors) grow continuously throughout its life. Its ears are massive, mobile and leathery, resembling those of a large bat. Its



An aye-aye in the forest canopy, after emerging from its nest at dusk, near Daraina in north-east Madagascar. The species is endemic to the country.



extraordinary hands have clawed fingers and a skeletal middle digit, and its mammary glands are low on the torso, between the hind legs. Add widely spaced, piercing orange eyes, a coarse, shaggy black coat and a long, bushy tail, and the overall effect is something resembling an electrocuted witch's cat with gremlin-like features.

Top: aye-ayes build nests from twigs and leaves. Above: an aye-aye skull and skeletal hand showing the long digit adapted for 'tap-scanning' (see box, p82). Left: hungry aye-ayes chewed all of these holes.

## GRUBBING ABOUT HOW THE AYE-AYE FEEDS



### 1 TAP-SCANNING

In this hunting technique, also known as 'percussive foraging', the aye-aye uses its bony middle finger to repeatedly tap the surface of a rotten tree trunk or branch. The animal's extremely sensitive touch and large ears enable it to echolocate wood-boring grubs, a prey item rich in nutrients.



### 2 CHEWING

The larvae live in tunnels and cavities that are 1–3cm beneath the surface. Once a grub is found, the aye-aye's chisel-like teeth make light work of the dead wood and a hole is quickly created. The speed is no surprise considering the species is able to gnaw through concrete (see box, p85).



### 3 GOUGING

Finally the aye-aye uses the same middle finger to fish out the insects. The digit is normally cooler than the ambient body temperature, but during tapping its temperature increases by several degrees Celsius, suggesting greater blood flow and therefore sensitivity.



## SOLVING THE PUZZLE

Aye-ayes are strictly nocturnal, mainly black, prefer to spend a lot of time high in the canopy, occur at low densities and occupy very large home ranges. So it is not surprising that there have been few successful wild studies. Eleanor Sterling from the American Museum of Natural History carried out some of the first ground-breaking investigations in the 1980s, and her studies still underpin much of our knowledge of the species in the wild.

“I spent two years on Nosy Mangabe, following aye-ayes throughout the night,” she says. “During the day they sleep high in the canopy in nests made from interwoven twigs and fresh and dead leaves. Nests may be occupied for several days, but there is high turnover and different individuals often use the same nest on different occasions.”

Aye-ayes have been regarded as solitary, only coming together when breeding, but Sterling's findings suggest otherwise. “They actually interact quite a lot outside the mating period. Animals come together in ‘tandem foraging’, often occupying adjacent or nearby trees while feeding. When one moves to another tree, they call quietly to one another and the second animal relocates nearby. They scent-mark too, telling others where

THE AYE-AYE RESEMBLES AN ELECTROCUTED CAT WITH GREMLIN-LIKE FEATURES.





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## MADAGASCAR’S OTHER ODDITIES

There are no squirrels or woodpeckers on Madagascar and the aye-aye evolved to fill those niches. This phenomenon, when unrelated species such as lemurs, squirrels and woodpeckers evolve similar solutions to the same problem, is known as convergent evolution. Here are four other Madagascan examples.

### 1 THE ‘TOUCAN’

The helmet vanga is the closest Madagascar has to a toucan. Vangas are a bird family endemic (unique) to the island, with a bewildering variety of body sizes, bill types and plumage. Arguably the family’s most spectacular member, the helmet vanga is found in rainforest in the north-east. It is an excellent hunter, spending long periods motionless before sallying out to pluck prey from branches or the leaf-litter.

### 2 THE ‘CAT’

Madagascar is missing many carnivores – it has no native cats, dogs, badgers, weasels, genets or otters, for example. The fosa, its largest carnivore, was wrongly described as a feline in

1833 due to the facial resemblance and semi-retractable claws. But it does hunt like an arboreal cat, being an agile climber. And it also has reversible ankle joints, so can descend trees by gripping with its rear feet behind its body, like the margay (a South American cat.)

### 3 THE ‘DORMOUSE’

The fat-tailed dwarf lemur is one of several tiny mouse and dwarf lemurs that enter periods of dormancy, much like dormice in temperate Europe and Asia. But whereas dormice hibernate in winter, these lemurs aestivate – a response to the dry season. To survive, the fat-tailed dwarf lemur builds up huge fat reserves in its swollen tail.

### 4 THE ‘HEDGEHOG’

Tenrecs are ancient mammals found primarily in Madagascar. Convergent evolution has driven the different species to resemble various small mammals from elsewhere in the world, such as shrews, moles and mice. The lesser hedgehog tenrec looks like a miniature hedgehog.



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they have been and possibly where to go. There may even be ‘highways’ along branches, routes that animals take and different animals follow on subsequent nights.”

When they become receptive, females scent-mark and are highly vocal, mating with different partners during one oestrus cycle. Each copulation lasts about an hour – a lengthy period for a primate. This is probably the male’s way of guarding against the advances of other suitors, but the ploy often fails, and the female begins calling again immediately to attract an alternative mate. Females begin breeding when three or four years old, and there is a three-year interval between births. Infants remain with their mother for a long period, allowing them to learn the complex foraging techniques needed for survival.

As if its striking appearance wasn’t enough, it is the aye-aye’s feeding habits that really set it apart. It is omnivorous, though insect grubs and ramy nuts *Canarium* sp. make up 90 per cent of its diet at times. Combining elements of both woodpeckers and squirrels (neither of which are found in Madagascar), it hunts for beetle grubs in rotting wood and uses its bony middle finger (the third digit) to extricate them (see box, p82). In contrast the fourth digit is more robust, so is used for tasks needing more strength such as accessing large fruit, scooping contents and exploring deep recesses.

Indeed most of the aye-aye’s anatomical peculiarities derive from its foraging and feeding adaptations. The roots of its huge, rodent-like teeth extend far back into the jaw,



Bristol Zoo’s Lynsey Bugg with Noah the aye-aye.

## AYE-AYES IN CAPTIVITY

Keeping aye-ayes in captivity demands specialist knowledge and husbandry techniques – in Europe the species is found at only six zoos. Durrell Wildlife Park and Bristol Zoo have two of the best exhibits.

Durrell’s Madelon Rusman says, “The aye-ayes’ distinctive musky smell and warm enclosures create a special atmosphere, where the quiet is interrupted only by the animals’ snorts and sniffs. Their diet is a careful balance of pellets, eggs, insects, fruit and vegetables, but coconut is their favourite.” Rusman emphasises the importance of a rich environment offering plenty to do. “Aye-ayes can chew through anything if they are bored – even concrete. We conceal insect grubs in bamboo sticks to simulate more natural behaviour.”

Lynsey Bugg from Bristol Zoo describes its aye-aye care regime: “As a precaution against gnawing we protect their enclosure’s ceiling with wire mesh, and the doors are metal. Recreating natural conditions is crucial, so our nocturnal exhibit not only replicates the correct balance between day and night, but also mirrors seasonality.” Bristol Zoo must be doing something right: towards the end of May one of its females gave birth, boosting the number of animals in Europe to 17, and those in captivity worldwide to 60.

resulting in the unusually wide spacing between the eyes. The middle finger on each hand is not only excessively thin, but also incredibly flexible and can rotate 360 degrees. Unlike other digits, it articulates through a ball-and-socket joint. The aye-aye also has an unusually large brain relative to the size of its body, a consequence of the complex hand, eye and auditory co-ordination that it requires.

### DISTRIBUTION DILEMMA

A quarter of a century after the Durrell ‘rescue mission’, are we any closer to knowing how many aye-ayes still survive in the wild? It’s a tough question. The continuing destruction of Madagascar’s forests is well documented, and this clearly correlates to there being fewer aye-ayes.

However, as more research has taken place an unexpected picture has emerged. Not only have aye-ayes now been recorded at numerous sites that stretch the entire length of the eastern rainforest belt, but they have also been found in drier forests in the far north, and in a number of deciduous forest locations on the western side of the island. This makes the aye-aye the most widely distributed primate species in Madagascar, other than *Homo sapiens*. In light of this broad distribution, the IUCN downgraded the species’ status to Near Threatened in 2008.

However, over the past 25 years Patricia Wright and Ed Louis have been at the forefront of lemur research across the island, and their independent studies suggest we may need to think again. On Nosy Mangabe the home ranges for males were up to 215ha (females’ are smaller), but in forests on the mainland they can be two or three times larger. And while aye-ayes can live in secondary forest, there is far more evidence of their presence in undisturbed forests, perhaps because these areas contain more old and dead wood with insect larvae. There is only 6–7 per cent of original forest cover left in Madagascar, so these factors in conjunction with the aye-aye’s taxonomy lead the two

Above: the forest near the village of Andranotsimaty (left) is one of the best places to search for aye-ayes, but is unprotected and threatened by extensive gold-mining (right). Below: the aye-aye (this one is female) is the world’s largest nocturnal primate.

WHEN THE GUIDE POINTED THE AYE-AYE OUT, MY POUNDING HEART MADE IT HARD TO FOCUS.





## SUPERSTITION, HUNTING AND PERSECUTION

The aye-aye's appearance and nocturnal habits have contributed to it becoming entwined in Malagasy folklore. There are many superstitions with considerable regional variation, but the gist across much of the island is that the animal is associated with bad luck or evil, and considered taboo. This means aye-ayes suffer direct persecution. Beliefs seem to be most extreme in the far north: for example, their dead bodies or tails are hung on poles at crossroads outside villages in the Ambanja region to prevent deaths, because it is believed that passing travellers will carry any curse or ill-fortune away with them. In contrast, the aye-aye is held in high regard in some parts of the south-east: here the animal is believed to embody ancestral spirits, and accorded the same rites as a chieftain after death.

Chris Golden, a research associate at the Harvard School of Public Health and research director with the Wildlife Conservation Society, runs a public-health research programme in north-east Madagascar and has spent over 15 years in and around remote villages.

"The aye-aye is the source of fascinating and divergent cultural associations," he says. "In some areas the animal is considered a bad omen and is killed to avoid bad luck or even death befalling children in villages. In others, the aye-aye is just a strange-looking lemur. In the Makira region, where I work, local people hunt the species for food. This involves cutting a circular patch of forest around a large fruit tree. The tree is then connected back to the forest by bridging poles on which snares are set. Aye-ayes and other lemurs jump across into the fruit tree. When they are full, they climb back using the bridges and are caught."



Sadly, aye-ayes are still caught for food in parts of Madagascar.

Christopher Golden

scientists to conclude that the species should instead be regarded as Critically Endangered.

I have been visiting Madagascar for more than 20 years, but have seen aye-ayes just seven times in the wild. My most recent encounter, in the dry forests near Daraina, was the most prolonged, though it only came about after a two-hour wait beneath a nest, followed by a long run to catch up with Amidou, a local guide and tracker. When he pointed the aye-aye out to me in the canopy, my pounding heart made it hard to focus. But eventually I saw the animal moving through the thinner branches then climb down a tree headfirst, its remarkable hands pulled into shapes resembling gnarled, contorted tarantulas. Stopping periodically, the aye-aye tapped the trunk with its middle finger, then listened for a grub concealed beneath. By the time it looked around for the next branch or trunk to jump to, the aye-aye was just 2m away, surely the closest you can get to a gremlin in this world. 🦉

**NICK GARBUTT** is a photographer and author. Visit <http://nickgarbutt.com> to find out more.

A female aye-aye foraging in the middle canopy and understorey of dry deciduous forest. Aye-ayes have no fixed breeding season.

### FIND OUT MORE

Learn more about aye-ayes with the American Museum of Natural History <http://bit.ly/1RGXEQC>, Bristol Zoo <http://bit.ly/1FoZqgk> and Durrell Wildlife Conservation Trust <http://bit.ly/1FoYIVX>