

# The legacy of the dodo— conservation in Mauritius

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Over the years *Oryx* has published several papers on the wildlife of Mauritius and its neighbouring islands and islets, and the *Oryx* 100% Fund has contributed towards some of the conservation work being done there. The author, who first visited Mauritius with the British Ornithologists' Union Expedition in 1973 and has played an active role in conservation plans since, brings us up to date with conservation in the area and highlights the steps that are essential if the wildlife that remains is to be saved.

The island that once sheltered the dodo is best known today as a producer of sugar and as a holiday resort. Indeed, over half the 1865-sq-km island is under sugar cane, and it is surrounded by sandy beaches with a wide lagoon inside a fringing coral reef. The distance and isolation that kept it free from human interference until the 1500s is now reduced to a couple of hours' flying time from the African coast, or just an hour from Madagascar.

Until man colonized Mauritius in the mid-1600s its entire surface was covered in forest. This was logged for ebony by the 17th century Dutch, for shipbuilding and agriculture by the 18th century French, and further in the 19th century by the new British rulers for space to grow sugar, fuel for trains and sugar factories, and extensive new upland settlements. Further deforestation in this century for sugar, tea and pine plantations, and for timber during the two world wars, has reduced the native forest to small areas of a few square kilometres, set in larger areas of very degraded forest, which nevertheless support some endemic lizards, birds and plants. The last straw for several endemic bird and plant species was the clearance during 1972–75, under World Bank auspices, of upland dwarf forest previously considered (rightly!) to be unsuitable for commercial forestry (historical details here and below are summarized from Cheke, 1987a).

*The legacy of the dodo*

Table 1 gives a graphic summary of history's devastation of the land vertebrates of Mauritius and its two neighbours, Réunion and Rodrigues, the ecological histories of which are sadly similar. This paper brings up to date the information given by Temple (1974); Moutou (1984) discussed Réunion more fully, as did Strahm (1983) and Carroll (1982) for Rodrigues.

The lost birds of the three islands include the entire endemic subfamily Rhaphidae (dodos and solitaires: three species, all flightless), two flightless rails, endemic ducks, sheldgeese, owls, pigeons and parrots. There were two endemic species of giant tortoise *Geochelone* spp. on each island, and Mauritius has lost the world's largest skink (*Leiopisma mauritiana*) and Rodrigues the largest gecko (*Phelsuma gigas*). The only

Table 1. Extinctions of land vertebrates in the Mascarene islands

	Per cent endemic species extinct		
	Mauritius	Réunion	Rodrigues
Birds	52% (11/21)	70% (16/23)	83% (10/12)
Mammals (fruit-bats)	67% (2/3)	100% (2/2)	50% (1/2)
Reptiles (mainland)	67% (8/12)	67% (4/6)	100% (4/4)
Reptiles (Round Island)	12% (1/8)	—	—

totally extinct fruit-bat, *Pteropus subniger*, was also the one with the most interesting biology—it roosted in large groups in hollow trees instead of hanging on branches like other flying-foxes. The situation on Mauritius is as bad for land snails (O. Griffiths, pers. comm.), but the status of most other invertebrates is not well known. There have been relatively fewer extinctions of plants, but many are reduced to one or a few individuals (Strahm, 1985). Of the surviving birds, two from Réunion, both from Rodrigues and seven of the 10 left in Mauritius are in the *Red Data Book*

(Collar and Stuart, 1985), as are five reptiles from Round Island, an islet 19 km off the north coast (Bullock, 1986: Groombridge, in prep.), and the Rodrigues flying-fox *Pteropus rodricensis* (Thornback, 1978). Mascarene species make up 26 per cent (11/43) of the entire African total of birds considered to be endangered or vulnerable (Collar and Stuart, 1985). The figures for Round Island are in striking contrast to the rest and will be discussed later. Table 2 summarizes the present position.

Table 2. The surviving endemic vertebrates of Mauritius

	RDB status	Réu*	Specific conservation measures
<b>Mammals</b>			
Mauritius flying-fox <i>Pteropus niger</i>	Rare	+	None
<b>Birds</b>			
Mauritius kestrel <i>Falco punctatus</i>	Endangered	(+)	Captive breeding; trial releases
Pink pigeon <i>Nesoenas mayeri</i>	Endangered	(+)	Captive breeding; trial releases
Echo parakeet <i>Psittacula eques</i>	Endangered	+	Nothing successful—see text
Mascarene cave-swiftlet <i>Collocalia francica</i>	Near-threatened (appendix C)	R	None (rapid recent decline, RDB status needs assessing)
Mascarene swallow <i>Phedina borbonica</i>	—	R	None (population of Mascarene race is very small, but there is another subspecies on Madagascar)
Mauritius cuckoo-shrike <i>Coracina typica</i>	Vulnerable	(R)	None (forest degradation and fragmentation is main threat)
Mauritius merle <i>Hypsipetes olivaceus</i>	Vulnerable	(R)	None (forest degradation and fragmentation is main threat)
Mascarene paradise-flycatcher <i>Terpsiphone bourbonensis</i>	—	R	Coppice management for nesting habitat at best site, where it is now threatened by the presence of monkeys (Mauritius population small)
Mascarene grey white-eye <i>Zosterops borbonicus</i>	—	R	None (not confined to native forest; the only common endemic)
Mauritius olive white-eye <i>Z. chloronothos</i>	Vulnerable	(R)	None
Mauritius fody <i>Foudia rubra</i>	Endangered	(+)	Attempted translocation to Réunion failed; otherwise none
<b>Reptiles</b>			
(Geckos)			
<i>Phelsuma guentheri</i> †	Endangered	—	Captive breeding
<i>P. cepediana</i>	—	(R)	None
<i>P. guimbeau</i>	—	—	None
<i>P. ornata</i>	—	R	None (Réunion race is very rare)
<i>Nactus serpensinsula</i> †	Rare	—	None
<i>N. coindemirensis</i> †	Rare	—	None
(Skinks)			
<i>Leiolopisma telfairii</i> †	Rare	+	Captive breeding
<i>Scelotes bojerii</i>	—	+	None (very rare on mainland)
(Snakes)			
Keel-scaled boa <i>Casarea dussumieri</i> †	Endangered	—	Captive breeding
<i>Bolyeria multicaïnata</i> †	Endangered	—	None (may be extinct; not seen since 1975)

\*The column headed 'Réu' indicates whether a species is or was shared with Réunion: R = shared and still extant, + = shared, but extinct on Réunion. Parentheses around the symbol indicate that a closely allied or sibling species is or was shared.

†Islets only; all but *Nactus coindemirensis* and *Bolyeria multicaïnata* are known to have occurred on mainland Mauritius in the past.

The native forests of Mauritius contain an astonishingly high proportion of trees endemic to either Mauritius or the Mascarene group, with somewhat lower endemism in shrubs and herbs. In addition, the vagaries of distance from the continents have made it a flora with a quite different balance of plant families from elsewhere. If the endemic animals and plants are to be saved (apart from in zoos and botanic gardens), the forest itself needs to be saved, which means somehow reversing the progressive degradation from introduced plants and animals.

There were originally three main types of forest: a rather open dry palm forest, a lowland semi-wet evergreen forest rich in black ebony, and the upland wet forest (Vaughan and Wiehé, 1937). Remnants of the first now survive principally on Round Island (North and Bullock, 1986), the second was the first of the natural resources to be pillaged and is now very fragmented, and only patches of upland forests that were too poor or inaccessible for timber exploitation now remain. In addition to attrition from illegal fuel-wood cutters, the remnants are being steadily degraded by the biological action of introduced animals (deer, pigs, monkeys, rats and giant snails *Achatina* spp.) and plants (notably strawberry guava *Psidium cattleianum*, a privet *Ligustrum walkeri* and a climber *Hiptage bengalensis*) (Owadally, 1980). The combined effect is largely to prevent regeneration so that the forests, including those in nature reserves, are slowly dying. I am at present trying to promote a long-term study on the dynamics of these decaying forests, within the context of an overall plant conservation programme funded by the World Wildlife Fund/International Union for Conservation of Nature and Natural Resources (WWF/IUCN), to understand the mechanism of what is happening (Cheke, 1985b)—only then can one produce management plans with any hope of long-term success. Small areas of the best-preserved patches are being fenced under the existing IUCN/WWF programme to provide deer- and pig-proof enclosures for planting out rare species propagated in the forestry service nursery (Strahm, 1985). The Mauritius Wildlife Appeal Fund has recently installed a warden to keep woodcutters of the coral islet of Ile aux Aigrettes in the lagoon near Mahebourg (MWAFF, 1986); im-

*The legacy of the dodo*

portant remnants of lowland forest are present, which, if protected, offer considerable scope for rehabilitation (Strahm, 1984).

Propagation of endangered plants by seed, cuttings, grafting and tissue culture is being pursued in Mauritius by the Forest Service and at several foreign botanic gardens. In 1985 an expedition from Dublin and Cambridge using mist-bench techniques achieved a high success rate with cuttings from a wide range of previously



The only known example of *Hyophorbe amaricaulis*, in Curepipe Botanic Gardens left standing, by chance, when the area was cleared to create the gardens (A.S. Cheke).

intractable species (MWF, 1986). Two laboratories have successively cultured embryos of *Hyophorbe amaricaulis*, a palm known from a single living specimen (Jackson *et al.*, 1986; Strahm and Nicoll, 1986). The same Dublin/Cambridge team has also demonstrated that germination of two forest trees is prevented by fungal rot of the seeds, due to the extinction of the animals that would normally eat the epicarp (Jackson *et al.*, in prep.), which presents major problems in ecosystem management if the phenomenon turns out to be common to other forest trees.

Although efforts at conserving firstly tortoises, then forests, were made in the 18th century, and bird protection laws were introduced in the 19th century, nothing was very effective. Modern conservation efforts really date from 1951 with the setting up of some reserves for different vegetation types, although these were neither big enough nor in the right places to suit birds and bats. As a result of fieldwork in the early 1970s, these reserves were considerably extended in 1974, the most significant being the linking of the Macabé and Bel Ombre reserves across Plaine Champagne to create a new reserve totalling 3611 ha and including a good proportion of the best bird habitat. Also in 1974 a captive-breeding programme, originally run by the International Council for Bird Preservation (ICBP), WWF and the Forestry Service, was started for the Mauritius kestrel, and this has since been expanded to include bats and reptiles as well as other birds, with the active participation since 1976 of the Jersey Wildlife Preservation Trust. In the same year the IUCN funded John Procter and Rod Salm to produce a detailed conservation strategy (Procter and Salm, 1975), which formed the basis for several later developments. In 1984 a working programme for wildlife research and conservation was set up by the Mauritian Government in partnership with the ICBP and the Jersey Wildlife Preservation Trust (Government of Mauritius, 1983); this was followed by a White Paper on conservation strategy in 1985 (Ministry of Agriculture, Fisheries and Natural Resources, 1985). Public appreciation of the uniqueness of the island's wildlife is being promoted by a Mauritian education officer, funded by ICBP, and the establishment of local wildlife clubs. The

situation nevertheless remains very precarious for several species.

Of the birds, the rarest is the echo parakeet *Psittacula eques*. In the early 1980s the total population was believed to be four (Jones, 1980), but a survey in 1983 showed that there were then probably 11 (Ahimaz, 1984; Collar and Stuart, 1985). After that no more than four were recorded until I saw six, one probably an immature, in late September 1985 (Cheke, 1985a; MWF, 1986). Loss of nesting sites as the old hollow trees fall and are not replaced, and loss of feeding habitat in the 1970s seem to be the most critical recent factors (Collar and Stuart, 1985; Jones, 1987). Nestlings taken for captive breeding in 1975–76 all died (Jones, 1980), but the situation was seen as being so critical that attempts were made more recently to trap adults for breeding in captivity, though without success as the birds defied baiting and roost trapping (Jones, 1980; Ahimaz, 1984; Collar and Stuart, 1985). Given the recent evidence of wild breeding, this approach is no longer favoured (Jones, 1986; MWF, 1986). At present the bird is being studied by Ed de Graaf, funded by the Dutch equivalent of the British Government Youth Training Scheme (de Graaf, 1986; MWF, 1986); he saw eight birds in May 1986 and estimates the current population as being not more than nine, including three pairs (de Graaf, 1986).

The Mauritius kestrel *Falco punctatus* shot to fame in the early 1970s as 'the rarest bird in the world', with an estimated population of just six, of which two were in captivity for breeding attempts (Temple, 1974; Jones, 1987). As the birds are very hard to census, this may have been a bit pessimistic (Collar and Stuart, 1985), but the situation was certainly desperate. In addition to deforestation and habitat degradation, the widespread use of DDT for malaria control throughout the 1960s is likely to have contributed to the decline, although there is no direct evidence for this (Jones, 1987). Initially, despite considerable investment of human and financial resources, the captive-breeding programme was a failure, whereas the wild birds managed to recover slowly on their own (Collar and Stuart, 1985). However, Carl Jones, who has been running the captive-breeding project since 1979, is now doing very

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Mauritius: the mountains behind Port Louis seen from the Vacoas Ridges. The canefields in the middle ground were still under logged-out forest in the 1930s, full of native birds. Below and to the left is Magenta where the first releases of captive-bred kestrels took place in 1986 (A.S. Cheke).

well with them. His team reared 14 young in the 1985–86 season, and has begun trial releases of captive-bred birds in suitable but unoccupied habitat. The wild population of some 19–25 birds (Jones, 1986) seems healthy, although still restricted in distribution (Fox *et al.*, 1985). They feed largely on endemic geckos *Phelsuma* caught on tree trunks (Fox *et al.*, 1985; Jones, 1985; Jones, 1987).

The pink pigeon *Nesoenas mayeri* has also had a lot of publicity from the high profile involvement of Jersey Zoo in its conservation and Gerald Durrell's book *Golden Bats and Pink Pigeons* (1977), in which he told about the first expedition to catch them for captive breeding. In this case captive breeding was an immediate success (Jones *et al.*, 1984), while the wild population, its principal feeding ground wiped out in the early 1970s, has continued to decline (Jones, 1987; Collar and Stuart, 1985). In the wild the birds have a very specialized diet of flowers and leaves, but in captivity they proved to be happy to eat more or less anything (Jones *et al.*, 1984). In 1984–85 a trial release of captive-bred grain-eating birds was made at the historic botanic gardens of Pamplemousses in the north of the island (Todd, 1985). This was biologically successful: the birds adapted well to the park and, with continued supplementary feeding, built

*The legacy of the dodo*

nests and laid eggs—but unfortunately vandals with catapults eventually killed most of them (MWAFF, 1986); they were too tame, as indeed are many of the endemic birds. The neighbouring island of Réunion, which still has good forest in places, may prove a better place to release captive birds for a safe future (Cheke, 1975). This solution is also available for the parakeet should captive breeding ever succeed (Cheke, 1975; Collar and Stuart, 1985), and possibly also for the kestrel, although a study on the availability of *Phelsuma* geckos would need to be done first.

The other forest birds are hanging on in the remaining habitat and, with one possible exception, do not at present require drastic measures of intervention. As none but the grey white-eye has a population exceeding 200 pairs, a census is overdue, the last survey dating from 1974 (Cheke, 1987b; Collar and Stuart, 1985). The exception is the Mauritius fody *Foudia rubra*, another bird badly affected by habitat loss in the 1970s (Cheke, 1983). In 1975 I tried to introduce it to suitable habitat in Réunion, but international bureaucracy and the worst cyclone for 15 years conspired to spoil the project, and I was able to release only three birds, which were never seen again (Cheke, 1980; Barré and Barau, 1982). In 1974–75 there lots of 'spare' birds around because of habitat clearance—now they are so

thin on the ground that it would be very hard to trap enough (Cheke, 1985a), and possibly dangerous to the population without a census first.

One of the interesting things about the vertebrate fauna is that many of the endemics are of Asian origin, when Africa and Madagascar are so much nearer. Amongst them are the echo parakeet, the flying-fox *Pteropus niger* (still reasonably common) and the cave swiftlet *Collocalia francica*. The swift was common in the 1970s (Cheke, 1987b), but on my return in 1985 I found its population had slumped dramatically, apparently due to people disturbing nesting caves, which are all easily accessible, by rubbish dumping, fires and vandalism of nests (Cheke, 1985a). I tried to initiate a census of active caves, with a view to protecting important ones by grilles, but I do not know if this will in fact take place: it would be an ideal project for a university expedition.

No discussion of conservation in Mauritius would be complete without a word about Round Island. This 152-ha islet is remarkable for the survival of endemic reptiles long extinct on the Mauritian mainland (Bullock, 1986). They include two species of a peculiar endemic subfamily (Bolyerinae) of boid snakes (see McAlpine, 1982), two lizards now found only there, and a third known from just one other islet; three other lizard species also found on Round Island are more widespread on the mainland or other off-shore islets—altogether a remarkable reptile fauna. The key to all this is that no rats have reached the island, although over the past two centuries two other unwelcome mammals have severely overgrazed the vegetation, causing the extinction of the endemic tortoises\* and the loss of a small patch of mixed forest (North and Bullock, 1986). The goats have now all been shot (Bullock and North, 1984), and the latest plan for

\*Bullock (1986) and North and Bullock (1986) have misinterpreted my remarks (Cheke, 1987) about tortoises on Round Island, and imply that I suggested that they were quite likely not to have been native. There is in fact no doubt at all that endemic Mauritian tortoises once inhabited Round Island; the only question is whether the animals found in 1844 (a century after their extinction on the mainland and other islets) were native ones that had survived, or imported ones released there at some unknown time. It is much more likely that they were native.



Mauritius fody—caught and released during the BOU expedition in 1975 (A.S. Cheke).

eliminating the rabbits, submitted by New Zealand expert Don Merton (Merton, 1985), was put into action, apparently successfully in July 1986; first reports suggest that the rabbits were all eliminated (C. G. Jones, *in litt.*). There is also a chance, sometime in the future, of setting up a back-up reserve for these reptiles on Ile aux Aigrettes: ways of eliminating the rats there are currently being investigated (MWAf, 1986). In the meantime Jersey Zoo has been breeding two of the rare lizards and, after initial difficulties, one of the snakes (Durrell and Durrell, 1980; Hartley, 1984; Tonge, 1986); the other snake has not been seen for some time, and may be extinct. Near Round Island is another islet, Gunner's Quoin, where a new species of gecko was discovered in 1982 (Bullock *et al.*, 1985); it is tiny, small enough to hide from the rats that eliminated the other lizards from there in the mid-1800s. Small lizards fare better than larger ones in the face of rats in New Zealand (Whitaker, 1978), and on the Mauritian mainland also it is the larger ones that have vanished.

The turning point in wildlife conservation in Mauritius came in 1973 with a report by Sir Peter Scott (Scott, 1973) and the first serious studies of bird biology, by S. A. Temple and the British Ornithologists' Union (BOU) Mascarene Islands Expedition. Since then there has been considerable progress, with international bodies co-operating with the Government and the Forestry Service to develop both conservation programmes and a long-term strategy. However, other pressures in an overpopulated and economically hard-pressed island (e.g. Desvaux, 1983) mean



New road under construction cutting through native forest near Bassin Blanc, August 1985 (A.S. Cheke).

that in some areas the situation has got worse. The new road to the south of the island through the forest past Bassin Blanc has allowed woodcutters' lorries into a previously inaccessible rich wildlife area. The legacy of the 1970s clearance and reforestation policy has meant further attrition and fragmentation of degraded but important bird habitats. Government sponsorship of deer ranching to boost meat production (largely for export) has increased pressure (both clearance and overgrazing) on lowland forest remnants, which are largely on private land owned by sugar estates and leased to hunting/ranching syndicates. Ile aux Aigrettes, nominally a nature reserve for coastal forest, had been extensively cut over by illegal woodcutters in the years between my visits in 1973 and 1985, though the new warden there should prevent further deterioration. Conservationists both on the island and internationally must therefore remain vigilant if gains are to be consolidated and further setbacks minimized. The fauna and flora of the Mascarenes are comparable to the Galápagos, Hawaii and New Zealand in terms of evolutionary isolation and biogeographical

*The legacy of the dodo*

interest, and the wildlife of Mauritius is of special significance to ecologists as it once included the creature that has become the very symbol of extinction. The dodo died out in the 1660s (Cheke, 1985c), and it has taken 300 years to begin seriously saving the remnants of the ecosystem in which it lived. Let us make Mauritius a fit memorial to that ungainly but charismatic bird.

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