

A tropical beach scene with palm trees and large rocks. The image shows a sandy beach in the foreground, with large, smooth, grey rocks scattered along the shoreline. The water is clear and blue, with gentle waves lapping at the shore. In the background, a dense line of tall palm trees stands against a clear blue sky. The overall atmosphere is serene and idyllic.

ISLAND *African* EXTINCTIONS

TEXT AND PHOTOGRAPHS BY PHIL HOCKEY

Islands have always fascinated biologists. Charles Darwin's visit to the Galapagos Islands was instrumental in shaping his evolutionary (and, at the time, revolutionary) thinking. Chance colonisations of islands by plants and animals, and their subsequent isolation, have given rise to unique biological communities. Sometimes, as with the lemurs and vangas of Madagascar, spectacular radiations occur, giving rise to high levels of endemism. Following approximately 120 million years of isolation from Africa and India, all of Madagascar's 50 primate taxa are unique to the island – as are 88 per cent of the reptiles, 80 per cent of the plants, and 56 per cent of the resident breeding birds.

Although isolation creates unique communities, it brings with it a unique suite of problems. Should conditions change, species unable to adapt or disperse elsewhere are doomed. Some changes are natural, such as the desertification of the eastern Canary Islands, but others are man-made, such as habitat alteration for agriculture, the introduction of alien predators and the introduction of disease.

Globally, approximately 136 species of birds (and a further 90 locally endemic subspecies) dwindled to extinction in the 400 years from 1600 to 2000. One hundred and twenty four of these post-1600 extinctions (91 per cent) occurred on islands. This figure is not representative of the total number of extinctions,

because many occurred before this time, following the earliest colonisations by man. In the African regions, these extinctions are well documented for the endemic birds of St Helena. Prior to 1600, three species of seabirds (as well as five non-endemic species – a rail, crane, dove, cuckoo and hoopoe) were driven to extinction by man and his introduced animals. Today, all of the nine land-bird species breeding on the island are aliens and only one endemic, the St Helena Plover, survives. The Hawaiian Islands and New Zealand have similar dismal histories.

Some of the post-1600 extinctions, such as those of the Great Auk *Alca impennis* of the north Atlantic and the dodos and solitaires of the Mascarene Islands, are fairly well known. Others have been less well documented and, in some instances, it is almost certain that unrecorded extinctions have taken place: the figure of 124 extinctions on islands is therefore a minimum. This article endeavours to summarise extinctions that have occurred on African islands and to identify where possible their causes and the lessons they hold for the future.

I have defined 'African islands' as being those lying to the east of the Mid-Atlantic Ridge, west of the Mid-Indian Ridge and north of 40°S. This encompasses islands from Madeira in the north-west to Tristan da Cunha in

The serenity of tropical islands, such as the Seychelles, belies the looming extinctions of many endemic birds.



The widely introduced Madagascar Fody competes with several Red Data Book species for nest sites and food.

A combination of felling and burning has fragmented the forests of Madagascar into almost treeless landscapes.

the south and Socotra in the north-east. An analysis of the chronology and geography of extinctions, and the numbers of currently endangered species, reveals some very obvious patterns.

- The number of extinctions has decreased progressively since 1600. There were 14 extinctions in the 17th century, 12 in the 18th, six in the 19th and three in the 20th. On the face of it this might appear to be encouraging, but bear in mind that as the number of extinct species increases, fewer species remain to become extinct. By contrast, not one bird species has become extinct on the African mainland during the same period, although some local populations have disappeared, such as the Moroccan guineafowl.

- Overall, the islands that have the most endangered species today are those that have experienced few or no extinctions. This suggests that these islands may now face an imminent extinction crisis.

- The geography of extinctions is uneven. Of the 35 species lost, all except five have been on the Mascarene Islands of Mauritius, Réunion and Rodrigues. However, the table on page 39 shows

quite clearly that local extinctions of native land birds on many islands have frequently exceeded 50 per cent of the original species' complement.

- The average rate of extinction on African islands to date has been one species every 11.5 years. Should 50 per cent of the 20 surviving critically endangered species become extinct over the course of the next 10 years, this rate would have increased to one species every year. (Critically endangered species are defined by the IUCN as having a probability of extinction greater than 50 per cent in the

Why should the Mascarenes have suffered so badly?

next 10 years.)

Many early travellers waxed lyrical about the diversity and abundance of birds on all three Mascarene islands, reporting dodos and ducks, rails and herons, parrots, pigeons and starlings. With precious few exceptions, these species are now consigned to history. Edible bird species were hunted mercilessly – the flightless ones soon succumbing to such



pressure. As early as 1613, Samuel Castleton wrote that on Réunion, 10 men armed with sticks and stones could kill sufficient White Dodos to feed 40 people – 160 years later, the White Dodo was no more. Over time, rats, mongooses, macaques and others (including many alien birds) were also introduced to the Mascarenes, where they continue to cause immense harm to native birds.

Today, more than 60 per cent of the land area of Mauritius is under intensive agriculture, and the few remaining patches of indigenous forest are heavily infested with alien trees. The human colonisation of Réunion also tells a chilling story. The first permanent settlement of the island took place in 1663 and by 1671 the human population had reached 76. In 1735 there were 8 150 residents, and 140 years later this had swelled to 67 000. By this time, seven Réunion endemics had been driven to extinction. In July 2000, the human population had reached 730 000; of the four remaining endemic species, only the Réunion Bulbul *Hypsipetes borbonicus* (whose specific status is questionable) and the Réunion Stonechat *Saxicola tectes* have escaped inclusion in the International Red Data

Book (RDB).

By 2000, the human population of Mauritius – a smaller and less rugged island – had reached 1 179 500, an average density of almost 670 people per square kilometre. Ten of the Mauritian endemics are extinct, two are critically endangered, three are endangered (20 per cent chance of extinction in 20 years) and four are vulnerable. Today, the only surviving endemic bird on Mauritius that is not included in the RDB is the Mauritius Grey White-eye *Zosterops mauritianus*. The story of the Mascarenes is a chilling parallel to that of the St Helena extinctions – the only difference is that human colonisation of St Helena happened about 100 years earlier.

São Tomé and Príncipe, by contrast, have experienced no documented extinctions and between them have 26 endemic taxa, of which 12 are included in the RDB. These islands are far less isolated than the Mascarenes and the adaptations of their birds may therefore be less extreme. Additionally, the human population density is only one quarter that of Mauritius and much primary forest remains on Príncipe, although São Tomé's primary forest is reduced to two patch-

Idyllic tourist paradise... but cultivation and reclamation have totally transformed the lowland forests and mangrove swamps of Mahé, Seychelles.

Translocations almost certainly saved the Seychelles Warbler from becoming extinct.



Locations and approximate dates of global extinctions on African islands, 1600–2000, and a comparison with species classified as 'Critically Endangered' or 'Endangered' by BirdLife International in 2000

MADEIRA	
EXTINCT SPECIES	
No extinctions or endangered species	

CANARY ISLANDS	
EXTINCT SPECIES	DATE OF LOSS

CAPE VERDE ISLANDS	
EXTINCT SPECIES	CRITICALLY ENDANGERED AND ENDANGERED SPECIES
No extinctions	Razo Lark <i>Alauda razae</i> ¹ Cape Verde Warbler <i>Acrocephalus brevipennis</i>

SÃO TOMÉ and PRÍNCIPE	
EXTINCT SPECIES	CRITICALLY ENDANGERED AND ENDANGERED SPECIES
No extinctions	Dwarf Olive Ibis <i>Bostrychia bocagei</i> ¹ São Tomé Fiscal Shrike <i>Lanius newtoni</i> ¹ São Tomé Grosbeak <i>Neospiza concolor</i> ¹

ASCENSION ISLAND	
EXTINCT SPECIES	
No extinctions or endangered species	

ST HELENA	
EXTINCT SPECIES	CRITICALLY ENDANGERED AND ENDANGERED SPECIES
No extinctions	St Helena Plover <i>Charadrius sanctaehelenae</i>

TRISTAN DA CUNHA GROUP	
EXTINCT SPECIES	CRITICALLY ENDANGERED AND ENDANGERED SPECIES
No extinctions	Spectacled Petrel <i>Procellaria conspicillata</i> ¹ Tristan Albatross <i>Diomedea dabbdadena</i>



White Mascarene Starling



Dutch Pigeon



Mascarene Parrot

ZANZIBAR and PEMBA	
EXTINCT SPECIES	
No extinctions or endangered species	

COMORO ISLANDS	
EXTINCT SPECIES	CRITICALLY ENDANGERED AND ENDANGERED SPECIES
No extinctions	Anjouan Scops Owl <i>Otus capnodes</i> ¹ Grand Comoro Scops Owl <i>O. pauliani</i> ¹ Moheli Scops Owl <i>O. moheliensis</i> ¹ Grand Comoro Flycatcher <i>Humblotia flavirostris</i> Grand Comoro Drongo <i>Dicrurus fuscipennis</i> Mayotte Drongo <i>D. waldenii</i>

SOCOTRA	
EXTINCT SPECIES	
No extinctions or endangered species	

SEYCHELLES (including ALDABRAS)		
EXTINCT SPECIES	DATE OF LOSS	CRITICALLY ENDANGERED AND ENDANGERED SPECIES
Seychelles Parrot <i>Psittacula wardi</i>	1870-1881	Seychelles Scops Owl <i>Otus insularis</i> ¹
Aldabra Warbler <i>Nesillas aldabrensis</i>	1986	Seychelles Magpie-Robin <i>Copsychus sechellarum</i> ¹ Seychelles Paradise Flycatcher <i>Terpsiphone corvina</i> ¹ Seychelles White-eye <i>Zosterops modestus</i> ¹

MASCARENES (more than one island)	
EXTINCT SPECIES	DATE OF LOSS
Mascarene Coot <i>Fulica newtoni</i>	1693
Mascarene Parrot <i>Mascarinus mascarinus</i>	1834-1840
White Mascarene Starling <i>Necropsar leguati</i> ²	1840

MAURITIUS		
EXTINCT SPECIES	DATE OF LOSS	CRITICALLY ENDANGERED AND ENDANGERED SPECIES
Mauritius Night Heron <i>Nycticorax mauritanus</i>	Pre-1700	Mauritius Parakeet <i>Psittacula echo</i> ¹
Mauritian Duck <i>Anas theodori</i>	1696	Mauritius Fody <i>Foudia rubra</i> ¹
Mauritian Red Rail <i>Aphanapteryx bonasia</i>	1693	Pink Pigeon <i>Columba meyeri</i>
Dodo <i>Raphus cucullatus</i>	1655	Mauritius Olive White-eye <i>Zosterops chloronothos</i>
Dutch Pigeon <i>Alectroenus nitidissima</i>	1826-1835	
Mauritius Grey Parrot <i>Lophopsittacus bensoni</i>	1765	
Broad-billed Parrot <i>L. mauritanus</i>	1675-1680	
Mauritian Barn Owl <i>Tyto sauzieyi</i> ³	1700	
Newton's Barn Owl <i>T. newtoni</i> ³	1700	
Commerson's Scops Owl <i>Scops commersoni</i>	1836-1850	

RODRIGUES		
EXTINCT SPECIES	DATE OF LOSS	CRITICALLY ENDANGERED AND ENDANGERED SPECIES
Unnamed petrel <i>Pterodroma</i> sp.	1726	Rodrigues Warbler <i>Acrocephalus rodericanus</i>
Rodrigues Night Heron <i>Nycticorax megacephalus</i>	1761	
Leguat's Rail <i>Aphanapteryx leguati</i>	1700-1760	
Rodrigues Solitaire <i>Pezophaps solitarius</i>	1765	
Rodrigues Pigeon <i>Columba rodericana</i>	1726	
Rodrigues Parrot <i>Necropsittacus rodericanus</i>	1761-1800	
Rodrigues Ring-necked Parakeet <i>Psittacula exsul</i>	1876-1880	
Rodrigues Little Owl <i>Athene murivora</i>	1726	
Rodrigues Starling <i>Necropsar rodericanus</i>	1726	
Unnamed bulbul <i>Hypsipetes</i> sp.	1600s	

RÉUNION		
EXTINCT SPECIES	DATE OF LOSS	CRITICALLY ENDANGERED AND ENDANGERED SPECIES
Unnamed night heron <i>Nycticorax</i> sp.	Pre-1700	Mascarene Black Petrel <i>Pterodroma aterrima</i> ¹
Unnamed stork <i>Ciconia</i> sp.	Pre-1674	Barau's Petrel <i>P. baraui</i>
Réunion Flightless Ibis <i>Borbonibis latipes</i>	1773	Réunion Harrier <i>Circus maillardi</i>
Unnamed falcon <i>Falco</i> sp.	Pre-1674	Réunion Cuckoo-shrike <i>Coracina newtoni</i>
Réunion Dodo (Solitaire) <i>Raphus solitarius</i> ⁴	1710-1715	
White Dodo <i>Victoriornis imperialis</i> ⁴	1770	
Réunion Crested Starling <i>Fregilupus varius</i>	1850-1870	
Unnamed fody <i>Foudia</i> sp.	1671	

MADAGASCAR		
EXTINCT SPECIES	DATE OF LOSS	CRITICALLY ENDANGERED AND ENDANGERED SPECIES
Elephant Bird <i>Aepyornis maximus</i> ⁵	1650	Alaotra Grebe <i>Tachybaptus rufolavatus</i> [extinct?] ¹
Snail-eating Coua <i>Coua delelandei</i>	1920-1930	Madagascar Pochard <i>Aythya innotata</i> [extinct?] ¹
		Madagascar Fish Eagle <i>Haliaeetus vociferoides</i> ¹
		Madagascar Serpent-Eagle <i>Eutriophis astur</i> ¹
		Sakalava Rail <i>Amauromis olivieri</i> ¹
		Meller's Duck <i>Anas melleri</i>
		Madagascar (Bernier's) Teal <i>A. bernieri</i>
		Slender-billed Flufftail <i>Sarothrura watersi</i>
		Madagascar Red Owl <i>Tyto soumagnei</i>
		Yellow-bellied (Sunbird-) Asity <i>Neodrepanis hypoxantha</i>
		Van Dam's Vanga <i>Xenopirostris damii</i>

* BirdLife International. 2000. *Threatened Birds of the World*. Barcelona & Cambridge, U.K.: Lynx Edicions & BirdLife International.

¹ BirdLife International.

² Critically endangered species.

³ Some authorities consider this to be the same species as Rodrigues Starling.

⁴ These two owls considered by some to be one species.

⁵ Some authorities do not distinguish between these two



The abandonment and encroachment of coconut plantations in Seychelles threaten the forest-dwelling Seychelles Magpie-Robin.

Major environmental change has occurred in the eastern Canary Islands, but much of this has been as a result of changing climate.

es. Similarly, the Comoro Islands (including the French territory of Mayotte) have experienced no extinctions, and have 16 endemics of which half are listed in the RDB. Human population density here is less than half that of Mauritius.

The causes of some of the early Mascarene extinctions are not documented, although the flightless species (dodos, rails and the flightless ibis) were undoubtedly hunted to extinction. Two pigeons and four parrots had also disappeared by the end of the 19th century. The Rodrigues Parrot was hunted, as probably were the pigeons, but the loss of these forest-dwelling fruit-eaters, along with four species of owls and three starlings, strongly suggests that the loss of lowland forests with the advent of agriculture had a devastating effect.

Direct and indirect effects of man

The 20 critically endangered species listed on pages 36 and 37 belong to disparate taxonomic groups, from grebes and eagles to white-eyes and fodies. If

the lists of extinct and endangered birds are combined (as an indication of the types of birds most under threat), small owls, pigeons and parrots seem to be at a disproportionately high risk, especially on small islands. In broad terms these can be classified as forest or woodland birds (as are some of the other critically endangered species, such as the São Tomé Grosbeak, Mauritius Fody and Seychelles Paradise Flycatcher). The small owls prey mostly on large invertebrates and small vertebrates, whereas fruit figures strongly in the diets of pigeons and parrots.

All forest-dwelling species are likely to be affected directly by a loss of habitat, especially on small islands, but frugivores seem to be particularly at risk. The reasons for this are probably twofold. Firstly, there is a mutualistic relationship between fruit-eating birds and the fruit-producing trees on which they depend. Many of these trees rely on the birds to disperse their seeds and, in particular, to transport those seeds between forest patches. As the distance between forest patches increases, journeys made by the birds between forest remnants become less frequent. In time, this will result in

some seed dispersal failure and certain tree species important to the birds will be lost from some forest patches. Should the 'lost' trees be critical fruit providers at a certain time of year, patches will eventually become less and less suitable as feeding grounds for birds – and the vicious spiral continues. Interestingly, frugivorous bats of the African islands seem to have been less impacted, possibly because their diets are less specialised and they can eat large fruits that may be unavailable to birds.

The second effect of forest fragmentation is to change the light and moisture regimes within the surviving patches. Forest edges are drier and brighter than forest interiors and support different tree species. As the forest patches become smaller, the ratio of 'edge' to 'core' habitat increases, and those birds dependent on trees, invertebrates or micro-habitats that are confined to forest interiors find progressively less suitable habitat. This habitat erosion can be seen in the forest fragments of Madagascar where the frequent burning of adjacent grasslands for agriculture gradually eats away at the forest fringes. Forest contraction can rapidly reduce the bird populations of the forest

cores to dangerously low numbers.

This can readily be seen on several African islands. On La Digue in the Seychelles, the woodland habitat of the Seychelles Paradise Flycatcher was reduced from 51 hectares in 1988 to 41 hectares by 1992. Some of the birds responded by moving out of the woodland into surrounding, marginal habitats, but there is no evidence that they can breed successfully in their 'secondary' homes. Other examples of forest birds being 'squeezed' in this way include the three critically endangered species of São Tomé (see page 36) and the recently discovered Anjouan Scops Owl of the Comoros. Although only listed as vulnerable in the RDB, the São Tomé Short-tail *Amaurocichla bocagii*, like the grosbeak, fiscal shrike and ibis, is entirely confined to the remaining primary rainforest and its RDB status may require revision. It is not only loss of forest area that can impact native species, but also invasion of forest by alien plants. For example, on Frégate Island in the Seychelles, collapse of the copra trade led to abandonment of coconut plantations and their subsequent invasion into the indigenous woodland. This has reduced the availability of suitable foraging habitat for the critically endangered Seychelles Magpie-Robin.

Forest loss has had, and continues to have, the greatest impact on small islands. There has been substantial forest loss on the huge island of Madagascar, but this was not responsible for the extinction of the giant elephant birds during the 17th century: these 400- to 500-kilogram giants were hunted to extinction by man. The only other documented extinction on Madagascar was the Snail-eating Coua. This bird was a forest-dweller, but was confined to the offshore island of Saint Marie where it was driven to extinction within the first 30 years of the 20th century by a combination of forest loss and introduced rats.

Introduced animals pose particularly severe threats to island bird populations and, to date, are probably responsible for the greatest number of extinctions. Unlike birds, land animals generally have very poor dispersal abilities and rarely reach islands unassisted. Some land birds, evolving in the absence of predators, became flightless – although all originated from flying ancestors. Others have retained the ability to fly but have lost the costly adaptations they once had for avoiding predators. The ▷



A comparison of extinction rates (global and local combined) of native terrestrial bird species present in 1600 and existing numbers of introduced (alien) species on the satellite islands of Madagascar

ISLAND	# in 1600	% extinct	# introduced
MASCARENES			
Mauritius	22	50	20
Réunion	19	53	9
Rodrigues	11	82	7
SEYCHELLES			
Mahé	9	22	8
Praslin	10	40	6
La Digue	8	60	7
Silhouette	5	20	6
Curieuse	4	25	5
Frégate	5	0	6
Marianne	6	50	5
Felicité	5	40	5
Aride	6	33	4
Cousin	6	0	6
Cousine	5	0	5
Bird Island	3	0	4
Aldabra Group	15	13	1
Astove	7	29	0
Assumption	4	50	4
Cosmoledo Group	7	43	0
Providence	1	100	1
Farquhar Group	1	100	2
Amirantes Group	2	100	5
COMOROS			
Grande Comore	33	0	10
Moheli	27	0	10
Anjouan	25	0	9
Mayotte	20	0	12

birds of St Helena and the Mascarenes have paid a high price for these introductions, as have birds on islands elsewhere. For example, the Stephen Island Wren *Xenicus lyalli* was discovered in 1894: in the same year, over the space of about one month, it was driven to extinction by the lighthouse keeper's cat (called Tibbles).

It is not only predators that cause problems. The ability of goats to transform landscapes is legendary: on St Helena they were probably the most important agent of forest loss and habitat transformation. As early as 1578, pigs, goats and 'other four-footed beasts' were reported to number 'in the thousands' on this one island of only 410 square kilometres.

Introduced birds have doubtless also affected indigenous species, although the extent to which this is a problem is not well understood (see page 39). Certainly, there are many introduced species on the islands: more alien bird species breed on Mauritius than in the whole of sub-Saharan Africa! On Mauritius, introduced Ring-necked Parakeets *Psittacula krameri* and Indian Mynas *Acridotheres tristis* compete with the critically endangered Mauritius Parakeet for nest sites, and in

Seychelles, the Madagascar Fody *Foudia madagascariensis* may compete with the Seychelles White-eye for both food and nest sites. The fody also competes for food with the endemic RDB fodies of Mauritius and Rodrigues.

Future prospects

Despite the islands' torrid history, man's intervention has, at least temporarily, saved several species from almost certain extinction. These include the Mauritius Kestrel, Pink Pigeon, Seychelles Magpie-Robin and Seychelles Warbler *Acrocephalus sechellensis*. Today, several of the critically endangered species of the African islands are the focus of national and international conservation efforts. Many of these bodies face an uphill task. Efforts on Mauritius depend heavily on captive breeding to supplement populations ailing from habitat degradation and introduced predators. In Seychelles, a supplementary feeding programme, provision of predator-proof nestboxes and inter-island translocation helped save the Seychelles Magpie-Robin. Translocation saved the Seychelles Warbler and, on

Aldabra, a trial translocation of the highly localised flightless rail is underway.

In most instances, however, the long-term success of these programmes will depend on solving the root cause of the original problem. In the case of predators and alien trees on Mauritius, for example, this is a daunting prospect, but one that ultimately will have to be addressed if the establishment of wild, self-sustaining populations is to be achieved. The control of coconut palm seedlings on Frégate Island in Seychelles, by contrast, could be relatively easily effected. What we can hope, however, is that the losses of the past and the danger signals of the present will serve to help us prevent further damage to the birds and other wildlife of Africa's fascinating but fragile island satellites. □

The illustrations of the White Mascarene Starling and the Mascarene Parrot on page 36 appear in Oiseaux de La Réunion (N. Barré, A. Barau & C. Jouanin, 1996) and are reproduced with kind permission of Les Editions du Pacifique, Paris. The illustration of the Dutch Pigeon appears in Extinct Birds (E. Fuller, 1987) and is reproduced with kind permission of Rainbird Publishing Group Ltd, London.

Lowland forest clearance and intensive agriculture contributed to the extinction of many species on Mauritius.

