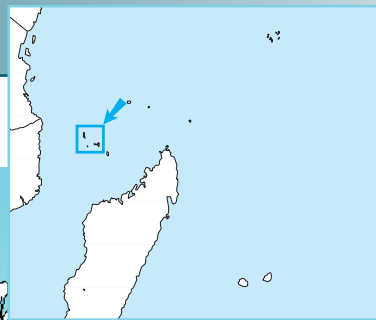


# THE COMOROS

ROGER J. SAFFORD



Grand Comoro Scops-owl  
*Otus pauliani*.  
(ILLUSTRATION: DAVE SHOWLER)

## GENERAL INTRODUCTION

The Federal Islamic Republic of the Comoros (hereafter referred to as the Republic) comprises the three western islands of the Comoro archipelago, and associated islets (11°20'S–12°25'S, 43°11'E–44°32'E). It excludes the fourth major island of the archipelago, Mayotte, which is a French dependency. The Comoros lie in the Mozambique Channel, at around the latitude of the northernmost point of Madagascar. The coasts of Mozambique and Madagascar lie c.300 km to the west and south-east, respectively. The land surface is 1,659 km<sup>2</sup>, consisting of the islands of (from west to east) Ngazidja (1,024 km<sup>2</sup>), Mwali (211 km<sup>2</sup>) and Ndzuani (424 km<sup>2</sup>). These are often referred to by their French names: Grande Comore, Mohéli and Anjouan. The length of coastline is 340 km.

Population data are difficult to interpret. A census in 1980 revealed a population of 356,142; of which 189,128 (185/km<sup>2</sup>) were on Ngazidja; 18,980 (90/km<sup>2</sup>) on Mwali; and 148,034 (349/km<sup>2</sup>) on Ndzuani, growing at 2.7% annually. Government statistics for 1991 give 233,533 on Ngazidja, 24,331 on Mwali, 188,953 on Ndzuani, a total of 446,817 and growth-rate (1980–1991) of 2.1%. The well-documented growth-rates of over 3.5% during the 1960s and 1970s have apparently decreased, although some sources have applied such growth-rates to the 1980 census data to give 1997 population estimates of over 520,000. Population densities and growth-rates are among the highest in Africa; Ndzuani supports over 950 persons/km<sup>2</sup> of cultivable land.

Ngazidja, Mwali and Ndzuani came under French protection in 1886, 45 years after Mayotte. In 1975, the three western islands gained independence, but Mayotte voted to remain French. Each island forms a Préfecture with a governor, and Ngazidja and Ndzuani are further divided into Sous-Préfectures. The capital and largest town, Moroni, is on Ngazidja. The Republic has suffered extreme political instability: 18 coups or attempted coups took place between 1975 and 1996. Ndzuani and Mwali attempted to secede in 1997, and the long-term outcome of this action is not yet clear.

The climate is tropical, with a hot rainy season from November to April, and a cooler, drier season from May to October. Mean annual

temperatures in coastal areas are c.25–26°C, with little seasonal variation and a decrease of 0.6–0.7°C per 100 m of elevation. The driest coastal areas receive c.1,000 mm of rainfall per year, but the uplands get much more (5,888 mm at Nioumbadjou, Ngazidja, and probably a similar amount on Ndzuani; 3,169 mm at Chalet St Antoine, Mwali). Cyclones bringing serious damage occur about every 10 years.

The islands are all volcanic in origin, and have never been united or connected to any other land mass. The youngest, Ngazidja, was formed in the quaternary. It has the only active volcano, Mount Karthala (2,361 m, the highest point in the archipelago), which erupted three times in the 1960s and 1970s. Apart from the crater, relief on Ngazidja is generally smooth, with no valleys or surface water, as rainfall percolates into the porous rock. Mwali and Ndzuani date to the late tertiary era and are highly eroded, with sharp ridges, precipitous slopes and numerous valleys, especially on Ndzuani. All three islands are partly surrounded by fringing reefs, best developed on Mwali and least on Ngazidja.

The dominant natural habitat is mixed montane forest. High mountain vegetation is restricted to Karthala, including montane bushland and thicket (tree-heath) and more stunted montane shrubland. Remnant semi-deciduous forests, once probably widespread at lower altitudes, are now very rare. Less than 100 ha of mangrove occur on Ngazidja and Mwali. The flora is not well documented. The often-quoted total of 935 species is certain to be a gross underestimate, 2,000 being a more likely total. Levels of plant endemism are not known. Of c.93 native, breeding vertebrate species (birds, reptiles and bats) and 82 butterfly species, 19 vertebrates (20% of the total) and 19 butterflies (23%) are endemic to the Republic, a further seven vertebrates (8%) and one butterfly are otherwise found only on Mayotte and/or Aldabra.

Since human colonization (over 1,000 years ago), at least 80% of the native vegetation has been destroyed. The land is dominated by plantations (mostly mixed cash-crops: coconut, mango *Mangifera indica*, clove *Syzygium aromaticum* and ylang-ylang *Cananga odorata*), subsistence cultivation (bananas, taro *Collocasia esculenta*, cassava *Manihot esculenta*, ambrevade *Cajanus cajan* and hillside

rice), and uncultivated land, including grassland, lava-flows and degraded, uncultivable areas known as padza.

Environmental problems on the Comoros are extremely severe, and inseparable from socio-economic problems; all arise from overpopulation, political instability, poverty and scarcity of natural resources. Agriculture leads the economy, but the country is not self-sufficient in food. Charcoal is still widely used as domestic fuel and also (very intensively) in the distillation of ylang-ylang. Poverty forces unsustainable exploitation of natural resources. Adoption of much-needed sustainable farming methods on existing agricultural land, and of alternative fuels such as kerosene, is hindered by the poor education of the workforce and the limited political support available to agriculture officials. The land becomes increasingly degraded by,

for example, cultivation methods that exclude any fallow period. All of these processes result in deforestation.

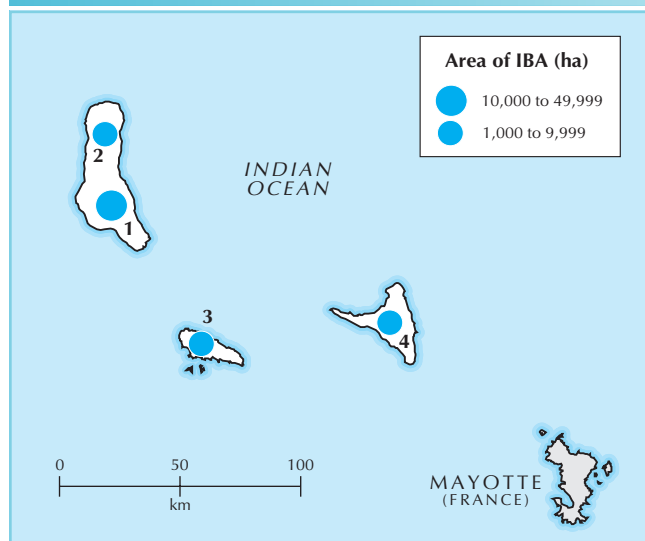
The pattern is similar on all islands, beginning at the lower margins of the native forest and gradually extending uphill. First, the undergrowth is removed to make way for cultivation (referred to as underplanting), typically of banana and taro, beneath a native canopy. Much native wildlife is found in underplanted forest, but the practice prevents forest regeneration and so the habitat is unlikely to be viable in the long term. Underplanted areas are often later cleared, usually for cultivation of hill rice, cassava, ambrevade or tree cash-crops. Fires used to clear remaining vegetation sometimes spread to neighbouring forest areas. Where land is abandoned, exotic vegetation (shrubby or herbaceous) generally takes over.

On Ngazidja, deforestation is proceeding rapidly up the slopes of Mount Karthala, which supports the most important forest on the Comoros. The remaining forest on La Grille is entirely underplanted, apart from forest fragments covering a few hectares, protected by their inaccessibility inside crater cones. Mwali, once noted for its relatively intact, unfragmented forest, and low population density, has suffered accelerated deforestation in the last 10 years. By contrast, deforestation proceeded rapidly on Ndzuani in the 1950s to 1980s, but may have slowed a little during the 1990s. This historical contrast between Mwali and Ndzuani is consistent with recent mass migration from Ndzuani to the less settled (forested) parts of Mwali, caused by the near-exhaustion of natural resources on Ndzuani and their supposed abundance on Mwali. In addition to the loss of biological diversity, deforestation has caused declining soil fertility, erosion (at worst, leading to formation of padza), shortage of wood for fuel and construction, siltation of coral reefs and possibly also the loss of at least 70% of approximately 45 permanent watercourses on Ndzuani.

Exotic species of plant and animal are abundant, many interacting with native species. Eight naturalized exotic mammal species include rats *Rattus* spp. and three carnivores (small Indian mongoose *Herpestes auropunctatus*, small Indian civet *Viverricula indica* and feral cats); of these, ship rats *Rattus rattus* probably affect native birds the most. The non-native mongoose lemur *Eulemur mongoz* is globally threatened in its native range (Madagascar) and the Comoros populations are of great importance for conservation, although they too are declining. Among the other exotic animals are six bird species, including *Acridotheres tristis*, and the large snake *Leioheterodon madagascariensis*. The impact of these and other exotic species on native wildlife is unknown, but they may affect native birds by predation, competition for food or nest-cavities, or by spreading disease. Invasion by exotic plants has not been studied, but species such as *Psidium cattleianum*, *Lantana camara* and *Mangifera indica* are already abundant in some forest areas.

Pollution from urban waste is severe. Sport- and subsistence-hunting affect some bird species. Natural impacts such as volcanic eruptions (on Ngazidja only) and cyclones are threats, especially to small, fragmented populations. Problems apparently unique to Mount Karthala (especially the high mountain vegetation) are fire and cattle-grazing. Illegal trade affects *Phelsuma* geckos, but not birds.

**Map 1.** Location and size of Important Bird Areas in the Comoros.



**Table 1.** Summary of Important Bird Areas in the Comoros. 4 IBAs covering 344.5 km<sup>2</sup>

IBA code	Site name	Administrative region	Criteria (see p. 11; for A2 code, see Table 2)		
			A1	A2	A4ii
KM001	Mount Karthala	Ngazidja	✓	✓	
KM002	La Grille	Ngazidja	✓	✓	
KM003	Mwali highlands	Mwali	✓	✓	✓
KM004	Ndzuani highlands	Ndzuani	✓	✓	
Total number of IBAs qualifying:			4	4	1

**Table 2.** The occurrence of restricted-range species at Important Bird Areas in the Comoros. Sites that meet the A2 criterion are highlighted in **bold**. Species of global conservation concern are highlighted in **blue bold**.

098 – Comoro Islands Endemic Bird Area (16 species in the Comoros; four sites meet the A2 criterion)				
IBA code:	001	002	003	004
<i>Columba pollenii</i>	✓	✓	✓	✓
<i>Alectroenas sganzeni</i>	✓	✓	✓	✓
<i>Otus capnodes</i>				✓
<i>Otus moheliensis</i>			✓	
<i>Otus pauliani</i>	✓			
<i>Hypsipetes parvirostris</i>	✓	✓	✓	
<i>Turdus bewsheri</i>	✓	✓	✓	✓
<i>Nesillas longicaudata</i>				✓
<i>Nesillas brevicaudata</i>	✓	✓		
<i>Nesillas mariae</i>			✓	
<i>Humblotia flavirostris</i>	✓			
<i>Nectarinia humbloti</i>	✓	✓	✓	
<i>Nectarinia comorensis</i>				✓
<i>Zosterops mouroi</i>	✓			
<i>Foudia eminentissima</i>	✓	✓	✓	✓
<i>Dicrurus fuscipennis</i>	✓			
Number of species recorded:	11	7	8	7

## ORNITHOLOGICAL IMPORTANCE

The Comoros support a distinctive avifauna, rich in endemic, forest-living species and especially subspecies. The total number of bird species recorded in the Republic (103 species) is low by continental standards, but the number of native breeding landbirds (47) is high for an oceanic archipelago, resulting from the proximity of Madagascar and Africa, from which the avifauna is derived. The remaining species are nine native breeding waterbirds and seabirds, 32 regular non-breeding migrants including all seabirds, nine accidentals and six naturalized exotics. Further coverage is certain to increase the numbers of accidentals and migrants, especially seabirds. Populations of shorebirds are not of global or regional importance. The importance of Comorian waters and reefs for non-breeding seabirds has not been assessed, but the mainland and especially islets of Mwali support breeding populations of several seabird species, which may increase with protection.

Of 13 species endemic to the Republic, one occurs on all three islands, two occur on Ngazidja and Mwali, and 10 are single-island endemics (five on Ngazidja, two on Mwali and three on Ndzuani). Three species are otherwise found only on Mayotte and/or Aldabra

and are therefore also restricted-range species. Non-endemic species are represented by 27 subspecies endemic to the Republic, 25 of which are single-island endemics. Six endemic species are globally threatened: *Otus pauliani* (CR), *Humblotia flavirostris* (VU), *Zosterops mouroniensis* (CR) and *Dicrurus fuscipennis* (CR) on Ngazidja, *Otus capnodes* (CR) on Ndzuani, and *Otus moheliensis* on Mwali; the last-mentioned species was described after the publication of Collar *et al.* (1994), but with a total population of c.400 individuals in a declining forest area, it is highly threatened and has subsequently been classified as Critical (BirdLife International 2000). The five remaining species of conservation concern are *Columba pollenii* (NT; resident, Comoro-endemic), *Nesillas mariae* (NT; resident, endemic to Mwali) and the mainly Malagasy *Ardea humbloti* (VU; visitor, may breed), *Ardeola idae* (NT; passage migrant) and *Circus maillardi* (NT; resident).

The Comoro Islands Endemic Bird Area (EBA 098)—the Republic and Mayotte—hold 19 restricted-range species, 16 occur in the Republic and 13 are confined to it (Table 2).

## CONSERVATION INFRASTRUCTURE AND PROTECTED-AREA SYSTEM

Comorian efforts to address environmental degradation and the loss of biodiversity became particularly active from the early 1990s onwards. Extensive new legislation, based on a Framework Law for the Environment, is being drafted, and large-scale projects are being developed with international funding to allow the Republic to meet its obligations under various environmental treaties ratified since 1993, especially the Convention on Biological Diversity. A National Environmental Policy was adopted in 1993, and an Environmental Action Plan was approved in 1994. Cross-sectoral committees for sustainable development at national and regional levels are to be established to complement the existing Direction Générale de l'Environnement, which is located in the Ministère de la Production, de la Pêche, de l'Élevage, des Forêts et de l'Environnement. A new GEF/Capacity 21 project, under way in 1998, will help to build Comorian capacity to conserve biodiversity within a framework of sustainable development, working also with staff from the Centre National de la Documentation et de la Recherche Scientifique.

Suggestions have been made for terrestrial and marine protected areas on or around all three main islands. Most advanced is the proposed Réserve Marine covering the reef, lagoon and islets near Nioumachoua on the south side of Mwali, but no legal declaration has taken place. Proposed terrestrial protected areas are: on Ngazidja, the upper and/or south-eastern parts of Mount Karthala; on Mwali, an extension of the proposed Réserve Marine up to and including the forested ridge; and on Ndzuani, a network of forest reserves. Recommendations that have been made emphasize the need for thorough integration with rural development initiatives. Traditional tenets and practices of Islam are supportive of conservation, but religious prohibitions on killing (for example lemurs, fruit-bats and turtles) are not universally adhered to.

## INTERNATIONAL MEASURES RELEVANT TO THE CONSERVATION OF SITES

The Republic has ratified the Convention on Biological Diversity (CBD), and has acceded to the Convention on International Trade in Endangered Species (CITES). It is a contracting party to the World Heritage Convention, the Convention to Combat Desertification, the Convention on Climate Change and the Ramsar Convention on Wetlands of International Importance, but the only Ramsar Site, Lac Dziani Boundouni (Mwali, 30 ha), does not meet quantitative criteria for qualification as an Important Bird Area. Other agreements include the United Nations Convention on the Law of the Sea (UNCLOS).

## OVERVIEW OF THE INVENTORY

This inventory contains four sites, covering an area of 344.5 km<sup>2</sup> (21% of the land area of the Republic): two on Ngazidja and one each on Mwali and Ndzuani (Table 1, Map 1). All are dominated by mixed montane forest, some of which is underplanted, but Mount Karthala (IBA KM001) also includes montane bushland and thicket,

and montane shrubland. None is protected, but all except La Grille (KM002) have been the subject of recommendations for some form of protection or controlled resource-use. Reliable, recent data on the distributions of all landbird species on the main islands are available, giving enough detail to ensure that the selection of sites is comprehensive. Site boundaries have been placed to include a generous amount of modified habitat (all inhabited by threatened or restricted-range species), especially underplanted forest. This cautious approach results in large sites. All 16 of the restricted-range species of the Comoro Islands EBA that occur in the Republic are well represented in the set of sites (Table 2). In fact, the IBA network probably contains the entire populations of five of the six threatened endemic species—the exception, *Dicrurus fuscipennis*, also occurs in exotic vegetation at sea-level, but is rare everywhere for reasons that are, as yet, unknown. No sites are known that regularly hold the coastal *Ardea humbloti*, a Malagasy species of global conservation concern which is not known to breed in the Republic.

## COMMENTS ON THE INVENTORY

- Place names and spelling follow those of the Institut Géographique National (1995), which are the only readily available maps of the Republic; these are phonetically rendered French versions of the local names. However, local names are used for the main islands. The land-use maps of Agrar- und Hydrotechnik (1987) were of value in identifying sites.
- Geographical and population data for the archipelago vary greatly with source, many of which do not indicate whether Mayotte is included; Battistini and Vérin (1984) give separate data for each island and are followed where possible, including the 1980 population data. Population data for 1991 come from Direction des Statistiques in Anon. (1993).
- No forest classification has been attempted. All humid evergreen forest in the Republic is here called mixed montane forest. The tiny areas of lowland forest are drier and classified as dry evergreen forest (although they are semi-deciduous). In Africa and Madagascar, montane forest is typically found only above 800 m, whereas on the Comoros it occurs lower than this.
- The number of sites is small because most forests exist as single blocks, which cannot easily be subdivided. On Ndzuani, the forest is fragmented but nevertheless is considered as a single site (KM004), since information on wildlife status and trends separated for each forest patch is not available, and all patches are (as far as is known) influenced by fairly similar environmental and socio-economic factors.
- The islets of Mwali and Ndzuani do not qualify as Important Bird Areas, although they support seabird populations of interest, especially the colony of *Sula dactylatra* on M'Chaco (see Draulans *et al.* 1985). Their actual and potential importance for conservation has hardly been considered, but they are reported to support remnants of plant communities not seen on the mainland. Such wildlife is potentially of immense interest, and these islets may, with appropriate management, support more important seabird colonies and terrestrial wildlife in the future.
- The three species here considered endemic to Ndzuani (*Otus capnodes*, *Nesillas longicaudata* and *Nectarinia comorensis*) have been treated as subspecies of *Otus rutilus*, *Nesillas typica* and *Nectarinia souimanga* (not restricted-range species) by some authors, although the distinctiveness of *O. capnodes* (Safford 1993) has been further substantiated (Moorcroft *et al.* 1996, Lewis 1997). The taxonomic treatment of these forms does not affect site selection.
- Information on taxonomy, endemism and distribution for non-birds is taken from Cheke and Dahl (1981; bats), Cole (1992; reptiles), Meirte (1994; reptiles) and Turlin (1995; butterflies). The most recent status information for the threatened, endemic fruit-bat *Pteropus livingstonii* is given by Action Comores (1997).

## ACKNOWLEDGEMENTS

Information on conservation infrastructure is taken from the GEF/Capacity 21 project document (UNDP 1997), supplied by G. Goncalves and J. Hough. Much information, especially concerning Mwali, was obtained from the report to FAO by J. P. Ledant (for 1993), and from N. Moulart (for 1996). References and

updated information were provided by Action Comores (particularly for Ndzuani) and M. Louette. Information on international conventions is taken from the web-sites of the respective conventions. Additional information and comments were received from R. Demey, M. I. Evans, A. Freeman, R.-M. Lafontaine, D. Lees, D. Meirte, R. Stobbs and I. Tattersall.

## SITE ACCOUNTS

### Mount Karthala

Admin region Ngazidja

Coordinates 11°46'S 43°21'E

Area 21,000 ha Altitude 600–2,361 m

KM001

A1, A2 (098)

Unprotected

#### Site description

Mount Karthala is the active volcano that dominates the southern part of Ngazidja. Its summit is the highest point in the Comoro archipelago. The site is centred on the summit crater and comprises all the unaltered vegetation and part of the altered, but still wooded, zone below and surrounding it. The lower limit is set to include the approximate region where threatened or restricted-range bird species that do not occur down to sea-level are still common. This limit is at c.600 m in the south-west, but up to 1,000 m in the north and east. The outer slopes are nowhere very steep and ridges, ravines, valleys, and indeed any permanent surface water, are totally absent. The outer rim of the crater lies at c.2,300 m, and is 2.5–3.5 km across. The crater contains abundant evidence of volcanic activity, with many steaming vents and recent lava-flows. An inner crater, c.1 km across, contains precipitous cliffs.

The lower parts of the site support underplanted forest and exotic thickets from abandoned cultivation. Above this lies intact, native mixed montane forest, which can be divided into dense, very humid forest with abundant epiphytes on the southern and western slopes, and drier, more open forest on the northern and eastern slopes. Higher still, up to and including the outer crater, lies high mountain vegetation. This zone is characterized by the ericaceous *Philippia comorensis*, in places forming a tree-heath taller than 3 m (montane bushland and thicket), but elsewhere lower and sparser (montane shrubland), depending on local conditions such as the age of lava-flows. The inner crater appears bare.

The altitudes of the boundaries between these zones vary locally. The lower limit of intact forest is retreating upwards as clearance proceeds. In the west (Boboni) in the mid-1990s, it was at c.1,250 m, in the east (Tsinimouapanga), at least 1,200 m. In the north-east, cultivation reaches at least 1,400 m and the forests have been entirely cleared. On this basis, the unaltered forest area in the mid-1990s may have been c.6,300 ha, compared to 8,658 ha in 1983. The high mountain zone (5,500 ha) typically begins at c.1,800 m, but extends down to 1,200 m on lava-flows in the south-east. The surroundings are mostly cultivated, except to the north, along the island's axis, where grassland dominates. In addition to agriculture in the lower areas the site is used for logging, cattle-grazing and limited collection of non-timber forest products.

#### Birds

See Box and Table 2 for key species. The site contains the complete community of forest-living birds of Ngazidja, which is the richest on the Comoro archipelago. Karthala supports the entire world population of three bird species, and most of the populations of two more. Of the latter, *Nesillas brevicaudata* is commonest on Karthala above 1,000 m but occurs lower down and also in La Grille (KM002), and the inexplicably rare *Dicrurus fuscipennis* is restricted to the environs of Karthala where it is uncommon in degraded forest below 1,000 m, but has also been found in coconut plantations on the coast. Six other restricted-range species occur, of which one, *Columba pollenii*, is near-threatened. Thirteen Ngazidja-endemic and six Comoro-endemic subspecies are present, and also the near-threatened, mainly Malagasy, *Circus maillardi*. No single area supports all the area's forest species. Although several species are widespread, bird distribution is affected by both habitat (forest or high mountain vegetation) and, within the forest zone, by altitude (an ill-defined transition between upland and lowland communities exists at 800–1,000 m). The non-threatened, restricted-range species all occur below 600 m, outside this IBA, but only *Foudia eminentissima* and *Nectarinia humbloti* occur below 400 m. A few species have been found at higher density in pioneer forest on lava-flows or underplanted forests than in unaltered forest.

## GLOSSARY

FAO Food and Agriculture Organization of the United Nations.

padza totally degraded land, devoid of vegetation.

#### Key species

A1	<i>Circus maillardi</i>	<i>Humblotia flavirostris</i>
	<i>Columba pollenii</i>	<i>Zosterops mouroniensis</i>
	<i>Otus pauliani</i>	<i>Dicrurus fuscipennis</i>
A2 (098)	Comoro Islands EBA: 11 of the 16 species of this EBA known from the Republic have been recorded at the site; see Table 2.	

#### Other threatened/endemic wildlife

Rich evergreen forest and high mountain flora, with many endemic and threatened species. Mammals: *Miniopterus minor griveaudi* (LR/nt; Ngazidja-endemic subspecies), *Rousettus obliviosus* (LR/nt). Reptiles: two Ngazidja- and four Comoro-endemic species: respectively, *Phelsuma comorensis*, *Furcifer cephalolepis*, *Phelsuma v-nigra*, *Mabuya comorensis*, *Lycodyras sanctijohannis*, *Typhlops comorensis*. Butterflies: nine Ngazidja- and two Comoro-endemic species; three threatened: *Papilio aristophontes* (EN), *Graphium levassori* (EN), *Amauris comorana* (EN).

#### Conservation issues

The site is unprotected, although suggestions for a protected area (National Park, Biosphere Reserve or Resource Management Area) have been made. This must be part of the development strategy for the island, with attention to encouraging locally organized ecotourism and the reforestation of the grasslands of the central ridge of the island. The major threat is clearance for agriculture: underplanting, followed by complete clearance. This occurs on all but the poorest soils. Large trees are selectively removed for making canoes. Secondary forest in the agricultural belt is dominated by the exotic strawberry guava *Psidium cattleianum*, and other exotic plant species are increasing. Commercial logging is very active on a 5,000 ha concession on the south-western slopes. Previous logging activity elsewhere has been abandoned, but logged areas have been taken over by agriculture. The tree-heath zone is threatened by browsing by cattle, and by fire used to stimulate growth of palatable shoots. A plan to build a road to the crater was abandoned in 1985 before construction could begin, but if carried out this could have many damaging impacts, such as increased disturbance, exploitation and fragmentation of the forest, and penetration by exotics. Hunting occurs, especially of pigeons. Introduced rats *Rattus* sp(p). are abundant in the forest.

#### Further reading

Benson (1960), Herremans *et al.* (1991), Louette (1988), Louette *et al.* (1988), Louette and Stevens (1992), Safford and Evans (1992), Stevens *et al.* (1992, 1995).

### La Grille

Admin region Ngazidja

Coordinates 11°29'S 43°20'E

Area 2,600 ha Altitude 800–1,087 m

KM002

A1, A2 (098)

Unprotected

#### Site description

La Grille is the extinct volcanic massif that dominates the northern part of Ngazidja. This site extends from the summit (Saondzou, 1,087 m) down to an altitude of 800 m. This includes nearly all of the area used by the restricted-range bird species present on the mountain, and all the forest. Relief is gentle, but interrupted by small (less than 1 km) raised craters, although the northern part of the mountain is steeper. The habitat is mixed montane (evergreen) forest, all of which is underplanted, apart from relict patches inside craters. The lowest parts of the site and its surroundings support cultivation including tree crops (mostly traditional practices, but also a farm established using overseas investment), secondary forest and grassland with bracken *Pteridium aquilinum* (especially to the south). A *Eucalyptus* plantation (probably dating to the 1940s) abuts the forest to the north-west.

## Birds

See Box and Table 2 for key species. La Grille supports a subset of the bird community of Karthala. Forest species absent include four of the five Ngazidja endemics (the one present is *Nesillas brevicaudata*), and other Karthala (KM001) lowland specialists. The two species of conservation concern are both near-threatened; *Circus maillardi* has not been documented at the site, but is certain to occur; *Columba pollenii* and six others are also restricted-range species, and two (*Turdus bewsheri*, *Foudia eminentissima*) show higher population densities here than on Karthala. Nine Ngazidja-endemic and five Comoro-endemic subspecies occur. The eucalyptus plantation is of no importance for birds.

### Key species

A1	<i>Circus maillardi</i>	<i>Columba pollenii</i>
A2 (098)	Comoro Islands EBA: Seven of the 16 species of this EBA known from the Republic have been recorded at the site; see Table 2.	

## Other threatened/endemic wildlife

Evergreen forest may show differences from Karthala, but is hardly studied. Butterflies: six Ngazidja- and two Comoro-endemic species; two threatened: *Papilio aristophontes* (EN), *Graphium levassori* (EN). No data on other taxa specific to this site.

## Conservation issues

The site is unprotected. In view of its degraded condition, and the fact that the bird community is a poor subset of that of Karthala, La Grille is not considered a high priority for biodiversity conservation and no reserves are proposed. However, absence of endemism has not been confirmed for fauna other than birds, or for flora. The major threat is continuing clearance for agriculture. Other threats are hunting (especially of pigeons) and invasion by exotics.

## Further reading

Benson (1960), Louette (1988), Louette and Stevens (1992), Stevens *et al.* (1995).

### Mwali highlands

Admin region Mwali

Coordinates 12°18'S 43°42'E

Area 4,000 ha Altitude 500–790 m

KM003

A1, A2 (098), A4ii

Unprotected

## Site description

The site comprises the central ridge and upper slopes of the island of Mwali, occupying the interior of the western two-thirds of the island above 500 m. The ridge is higher than 700 m for about 8 km of its length, between Mlédjélé in the east and the Chalet St Antoine in the west; the highest part being Mzé Koukoulé (790 m). Numerous small valleys extend to the coast on either side of the ridge. Habitation is restricted to the coast, except on the deforested Djandro Plateau in the east of the island. This site contains the catchments of the towns Fomboni (the island capital), Nioumachoua and Miringoni.

The major habitat is mixed montane forest, rich in epiphytes and pteridophytes, but distinct from that of Ndzuani and Ngazidja. Low, poorly stratified cloud-forest dominates the ridges. In less exposed sites, a more diverse, stratified forest with a 30–40 m canopy and emergents up to 48 m is found. Dry evergreen forest survives only above Miringoni. Underplanted forest forms a mosaic with intact forest above c.600 m, but dominates below this level. Thickets of exotic *Syzygium jambos* also occur, especially along riverbanks, where they may be mixed with other shade-bearing exotics and native species. Other abundant, invasive exotics are *Lantana camara* and *Clidemia hirta*, but not yet (1996) *Psidium cattleianum*. Forest plantations (*Pterocarpus indicus*, *Eucalyptus robusta*, *Tectona grandis*) exist in small areas, and these trees are also widely scattered. A survey in 1983 reported 1,553 ha of intact forest and 1,904 ha of underplanted forest. The area of intact forest has certainly declined by a further several hundred hectares since then; an estimate of 1,145 ha was made in 1996. The main forest-use is cutting of trees and associated conversion for agriculture. Non-timber forest products are also harvested (such as fruits of *Tambourissa* spp.).

## Birds

Mwali supports a unique forest bird community, including two Mwali-endemic species: the newly-described, threatened *Otus moheliensis* (common in intact forest, less so in underplanted forest),

and the Near Threatened *Nesillas mariae*. Six other restricted-range species and one seabird also breed, of which one, *Columba pollenii*, is near-threatened. Twelve Mwali-endemic and seven Comoro-endemic subspecies are also present, along with the near-threatened, but non-endemic, *Circus maillardi* (found in all habitats). Most of the threatened and restricted-range species are associated with the intact forest and are fairly common in it, although all have been seen outside it (some even at sea-level). *Puffinus lherminieri* breeds in forest at this site.

### Key species

A1	<i>Circus maillardi</i>	<i>Otus moheliensis</i>	
	<i>Columba pollenii</i>	<i>Nesillas mariae</i>	
A2 (098)	Comoro Islands EBA: Eight of the 16 species of this EBA known from the Republic have been recorded at the site; see Table 2.		
A4ii		Breeding (pairs)	Non-breeding
	<i>Puffinus lherminieri</i>	300+	—

## Other threatened/endemic wildlife

Evergreen forest is likely to be rich in Mwali- and Comoro-endemic species. Mammals: *Pteropus livingstonii* (CR; endemic to Ndzuani and Mwali, Mwali population c.60), *Rousettus oblioviosus* (LR/nt; Comoro-endemic species), *Eulemur mongoz* (VU; introduced, but very important population on Mwali). Reptiles: six Comoro-endemic species: *Lycodryas sanctijohannis*, *Paroedura sanctijohannis*, *Phelsuma v-nigra*, *Amphiglossus johanna*, *Mabuya comorensis*, *Typhlops comorensis*. Butterflies: one Mwali-endemic and four Comoro-endemic species (three shared only with Ndzuani).

## Conservation issues

The site is unprotected, but recommendations have been made to protect it by extending the Réserve Marine de Nioumachoua. Because of its relatively unfragmented forest area, and the relatively low population density compared to Ndzuani, Mwali's wildlife has been considered less threatened, but recent human population increases have led to such deforestation that the total area of intact forest may now be less than on Ndzuani. The biggest threat to native wildlife is continuing conversion of the forest to agriculture, exacerbated by the increasing population, with immigrants arriving from the neighbouring island of Ndzuani. As usual, converted land progresses from underplanted forest to cultivated or abandoned land with only scattered exotics, highly susceptible to erosion and landslides. Forest exploitation is concentrated at the eastern and western extremities of the forested area, and also above Fomboni. By comparison, collection of non-timber forest products seems a minor threat. Hunting occurs, probably affecting the cavity-nesting *Otus moheliensis* as well as pigeons, as is known to be the case on Ndzuani. Exotic plant species are abundant in the forest. Introduced rats are also abundant, and the arrival of the small Indian mongoose *Herpestes auropunctatus* from Ngazidja would probably cause the national extinction of *Puffinus lherminieri*.

## Further reading

Action Comores (1997), Benson (1960), Cheke and Diamond (1986), Lafontaine and Moulaert (1998), Ledant (1993), Louette (1988), Louette *et al.* (1989), Louette and Stevens (1992).

### Ndzuani highlands

Admin region Ndzuani

Coordinates 12°13'S 44°26'E

Area 6,850 ha Altitude 600–1,595 m

KM004

A1, A2 (098)

Unprotected

## Site description

The site comprises the central highlands of the island of Ndzuani, consisting of four main mountainous blocks. The north-western block (2,650 ha) includes the island's highest peak (Ntingui, 1,595 m, directly above the island capital, Moutsamoudou), and the crater-lake Dzilandze, and is linked to the southern block by a ridge (c.930 m above sea-level near Dzilandze). The southern block (3,350 ha) includes Trindrini summit (1,474 m), the Forêt de Moya, the ridges of Hamjantro and Hasiaka, and the crater Dzialoutsounga. A sharp ridge (Ngani pass, 868 m) links Trindrini to the eastern block (350 ha), which is the peak and associated ridges of Habakari mountain (1,242 m). The Col de Patsi (700 m) links Ntingui to the north-eastern block (500 ha), which is the peak and associated ridges of Djadjana mountain (1,089 m).

Relief is extremely precipitous, with many sharp ridges, ravines, sharply pointed summits and very steep slopes. The site contains all the remaining, scattered remnants of the island's mixed montane forest, and also the catchments for nearly all of the coastal towns and densely inhabited inland plains (locally known as *cuvettes*). Forest is restricted to the steepest slopes, and resembles that of Mwali (KM003), with very large trees in places, but the abundance of orchids and pteridophytes and presence of occasional *Philippia* sp. is reminiscent of Karthala (on Ngazidja, KM001). In 1983, intact forest was estimated to cover 2,164 ha, with 6,118 ha underplanted, sometimes on slopes of at least 45°. Recent estimates vary, but all authorities agree that less than 2,500 ha of intact forest remained in the 1990s and the current total could be only half that, as degradation continues. The main forest areas appear to be the immediate surroundings of Ntingui and Trindrini; the Bandani, Choungoui, Gnavivi and Koundré river catchments; and the north face of Habakari. The extensive Forêt de Moya is almost totally underplanted. The main forest-use is cutting of trees for timber, charcoal manufacture and conversion for agriculture. Non-timber forest products are also harvested or hunted (birds, exotic tenrecs *Tenrec ecaudatus*).

### ■ Birds

Three species are endemic to Ndzuani, one of which, *Otus capnodes*, is threatened, though frequent in both intact and underplanted forest. Among the four other restricted-range species, *Columba pollenii* (uncommon in intact and underplanted forest) is Near Threatened. The near-threatened non-endemic *Circus maillardi* also occurs. Seven Ndzuani-endemic and eight Comoro-endemic subspecies are also present; of the former, two (*Turdus bewsheri bewsheri* and the rare *Leptosomus discolor intermedius*) are very distinctive.

#### Key species

A1 *Circus maillardi* *Otus capnodes*  
*Columba pollenii*

A2 (098) Comoro Islands EBA: Seven of the 16 species of this EBA known from the Republic have been recorded at the site; see Table 2.

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### ■ Other threatened/endemic wildlife

Evergreen forest likely to be rich in Ndzuani- and Comoro-endemic species. Mammals: *Pteropus livingstonii* (CR; endemic to Ndzuani and Mwali, Ndzuani population c.350–400; c.85% of global total), *Rousettus obliviosus* (LR/nt; Comoro-endemic species), *Myotis goudoti* (LR/nt; Ndzuani-endemic subspecies), *Eulemur mongoz* (VU; introduced, but very important population on Ndzuani). Reptiles: six Comoro-endemic species: *Paroedura sanctijohannis*, *Phelsuma v-nigra*, *Amphiglossus johanna*, *Mabuya comorensis*, *Lycodryas sanctijohannis*, *Typhlops comorensis*. Butterflies: five Ndzuani- and four Comoro-endemic species (three shared only with Mwali).

### ■ Conservation issues

The problems of overpopulation and natural-resource degradation on Ndzuani are among the worst in Africa. The forests are at present unprotected, and the severity of environmental problems would complicate the creation of reserves. The major threat to native wildlife is deforestation, which follows the same progression with the same causes as elsewhere in the Republic: underplanting (removing undergrowth and preventing regeneration) followed by clearance for treeless cultivation (see 'General introduction'). Charcoal requirements on Ndzuani, for distillation of ylang-ylang *Cananga odorata*, are high: around 1990, 300 distilleries consumed 55 tonnes per year. New roads and tracks have assisted forest exploitation by easing accessibility to the forest. This virtually complete exhaustion of natural resources on Ndzuani has resulted in emigration to Mwali (KM003), bringing accelerated degradation there (see 'General introduction'). Hunting affects pigeons, *Accipiter francesiae* and *Otus capnodes*. Exotic plant species and rats are abundant in the forest. Finally, severe cyclones are a threat to the forest habitat, perhaps more on Ndzuani than other islands because of the extreme forest fragmentation.

### ■ Further reading

Action Comores (1992, 1997), Benson (1960), Louette (1988), Louette and Stevens (1992), Moorcroft *et al.* (1996), Safford (1993).