

MADAGASCAR

PROJECT ZICOMA



Brown Mesite
Mesitornis unicolor.
(ILLUSTRATION: DAVE SHOWLER)

GENERAL INTRODUCTION

The island of Madagascar (Republic of Madagascar) is situated in the south-western Indian Ocean, at the edge of the tropical belt, between the latitudes of 11°57'S and 25°30'S and between the longitudes of 43°14'E and 50°27'E. It is the fourth largest island in the world, stretching more than 1,500 km from north to south and 500 km from east to west, and has a surface area of 594,000 km².

The total human population is about 14.2 million (1998), which for a country of this size is relatively low; moreover only 27% of the population is urban. The average annual population growth-rate is 3.1% and 50% of the population is under 15 years. The main urban centres are Antananarivo (about 1.8 million), Tamatave (Toamasina), Antsirabe, Fianarantsoa, Toliara, Mahajanga and Diego-Suarez (Antsiranana), all of which have populations of less than 500,000.

Geologically, Madagascar consists of a Precambrian platform, the western third of which is overlain by more recent sedimentary rock. In general, the terrain is dominated by a central mountainous spine, running down the length of the island, and level surfaces are rare. Slopes on the eastern, Indian Ocean side of the island are steep, and overlook a narrow coastal plain. The western slopes, facing the Mozambique Channel, are more gradual, and consist of eroded sandstone or limestone. Coral reefs and islands are scattered offshore, especially in the north-west. The so-called High Plateau occupies the central two-thirds of the country, varying in elevation from 800 to 1,600 m, with the highest peaks above 2,500 m (Tsaratanana, Andringitra, Ankaratra). The southern part of the island consists of penepains, with the volcanic Androy massif in the east and the limestone Mahafaly plateau in the west.

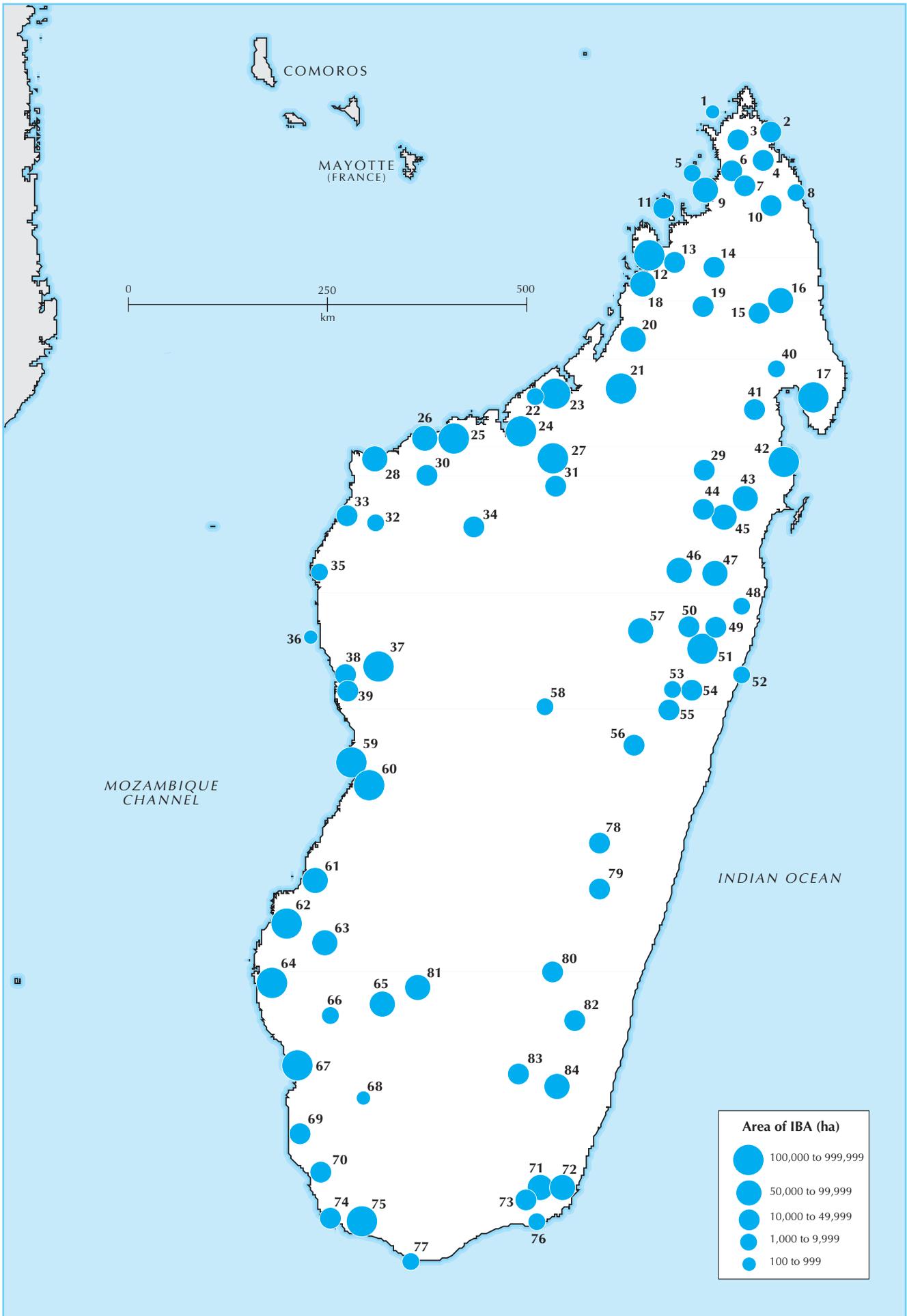
The average annual temperature varies by 3°C between the far north and the far south (26°C versus 23°C), and by c.13°C between the coast and the highest altitudes. Most of Madagascar has a tropical rainfall regime, with a dry season during the austral winter. On the eastern slopes, which intercept the year-round south-east trade winds, the annual rainfall exceeds 1,600 mm everywhere and,

exceptionally, surpasses 4,000 mm in some coastal and elevated areas. The rain is quite evenly distributed over the year—even during the drier months (from July to November), the average monthly rainfall is still between 80 and 300 mm. The west of the island is exposed to seasonal north-west monsoon winds during the austral summer. In the north-west (Sambirano) and far north regions, these winds also bring more than 1,600 mm of rain per year, although the dry season is more distinct than in the east. Temperatures here are higher than in the rest of the island, with relatively little annual variation. The rest of the western region receives between 800 and 1,600 mm of monsoonal rain per year, with a very marked dry season. Here, there are both maritime and continental temperature regimes, with significant temperature differences. The High Plateau has a tropical montane climate, with markedly lower temperatures than in the east or west. In general, the annual rainfall does not exceed 2,000 mm, but it does vary widely according to the relief and exposure. There is a marked dry season, but less so than in the west. Rainfall decreases gradually towards the south-west and totals less than 500 mm per year in a sub-arid strip from Morombe to Cape Sainte Marie, although the dry season here is also less marked than in the west, owing to sporadic winter rains during May–June. Temperatures are also lower than in the west, and vary more over the seasons.

There are five main rainfall-catchment areas on the island: the Montagne d'Ambre massif; the Tsaratanana massif; the eastern slopes; the western and north-western slopes; and the southern slopes. Generally, the eastern slopes are drained by many short, but quite fast-flowing, permanent streams and rivers, descending rapidly to the Indian Ocean down the scarp. Larger, longer, slower-flowing, more seasonally variable rivers, rising on the High Plateau, drain the western slopes, e.g. the Betsiboka, Tsiribihina and Mahavavy. In the far south of the island, watercourses remain dry for most of the year.

Most lakes in Madagascar are less than 1 km² in extent, and only 18 are larger, including (in the east) Lake Alaotra (the largest) and the Pangalanes, a system of acid, nutrient-poor coastal lagoons

Map 1. Location and size of Important Bird Areas in Madagascar.



Important Bird Areas in Africa and associated islands – Madagascar

Table 1. Summary of Important Bird Areas in Madagascar.			84 IBAs covering 52,797 km ²									
IBA code	Site name	Administrative region	Criteria (see p. 11; for A2/3 codes see Tables 2/3)									
			A1	093	094	A2 095	096	097	A3 A14	A15	A4i	
MG001	Cape Anoronaty archipelago	Antsiranana	✓							✓		✓
MG002	East coast of Antsiranana	Antsiranana	✓					✓		✓		
MG003	Montagne d'Ambre National Park and Special Reserve	Antsiranana	✓		✓						✓	
MG004	Analamera Special Reserve	Antsiranana	✓	✓						✓		
MG005	Mitsio archipelago	Antsiranana	✓							✓		
MG006	Ankarana Special Reserve	Antsiranana	✓	✓						✓		
MG007	Andavakoera Classified Forest	Antsiranana	✓							✓		
MG008	Lake Sahaka Hunting Reserve	Antsiranana						✓		✓		✓
MG009	Ambavanankarana wetlands	Antsiranana	✓					✓		✓		✓
MG010	Daraina Forest	Antsiranana	✓	✓	✓					✓		
MG011	Nosy Be and satellite islands	Antsiranana	✓							✓		
MG012	Ampasindava Bay wetlands	Antsiranana	✓					✓		✓		
MG013	Manongarivo Special Reserve	Antsiranana		✓	✓							✓
MG014	Tsaratana Strict Nature Reserve and adjacent areas	Antsiranana	✓		✓	✓						✓
MG015	Anjanaharibe-South Special Reserve	Antsiranana	✓		✓							✓
MG016	Marojejy National Park	Antsiranana	✓		✓							✓
MG017	Masoala National Park	Antsiranana	✓		✓							✓
MG018	Sahamalaza Bay wetlands	Mahajanga	✓							✓		✓
MG019	Ankaizina wetlands	Mahajanga	✓			✓					✓	
MG020	Loza Bay wetlands	Mahajanga	✓							✓		
MG021	Port-Bergé wetlands	Mahajanga	✓					✓		✓		
MG022	Ankobohobo wetlands	Mahajanga	✓							✓		
MG023	Mahajamba Bay wetlands	Mahajanga	✓					✓		✓		✓
MG024	Bombetoka Bay and Marovoay wetlands	Mahajanga	✓					✓		✓		✓
MG025	Mahavavy delta wetlands	Mahajanga	✓	✓				✓		✓		✓
MG026	Baly Bay National Park	Mahajanga	✓	✓				✓		✓		✓
MG027	Ankarafantsika Strict Nature Reserve and Ampijoroa Forestry Station	Mahajanga	✓	✓						✓		
MG028	Cape Saint André Forest and wetlands	Mahajanga	✓	✓				✓		✓		
MG029	Marotandrano Special Reserve	Mahajanga	✓		✓							✓
MG030	Namoroka Tsingy Strict Nature Reserve	Mahajanga	✓	✓						✓		
MG031	Maevatanana–Ambato–Boeni wetlands	Mahajanga	✓					✓		✓		
MG032	Maningoza Special Reserve	Mahajanga		✓						✓		
MG033	Bemarivo Special Reserve	Mahajanga		✓						✓		
MG034	Kasijy Special Reserve	Mahajanga		✓						✓		
MG035	Tambohorano wetlands	Mahajanga	✓					✓		✓		✓
MG036	Iles Barren complex	Mahajanga	✓							✓		✓
MG037	Bemaraha Tsingy National Park and Strict Nature Reserve	Mahajanga	✓	✓				✓		✓		
MG038	Bemamba wetland complex	Mahajanga	✓	✓				✓		✓		✓
MG039	Manambolamaty wetland complex and Tsिमembo Classified Forest	Mahajanga	✓	✓				✓		✓		✓
MG040	Anjanaharibe Classified Forest	Toamasina	✓		✓							✓
MG041	Upper Rantabe Classified Forest	Toamasina	✓		✓							✓
MG042	Mananara-North National Park	Toamasina	✓		✓							✓
MG043	Ambatovaky Special Reserve	Toamasina	✓		✓							✓
MG044	Bidia Classified Forest	Toamasina			✓							✓
MG045	Bezavona Classified Forest	Toamasina	✓		✓	✓				✓		
MG046	Lake Alaotra	Toamasina	✓			✓				✓		✓
MG047	Zahamena National Park	Toamasina	✓		✓					✓		
MG048	Betampona Strict Nature Reserve	Toamasina	✓		✓					✓		
MG049	Mangerivola Special Reserve	Toamasina	✓		✓					✓		
MG050	Didy and Ivondro wetlands	Toamasina	✓			✓				✓		✓
MG051	Sihanaka Forest	Toamasina	✓		✓					✓		
MG052	North Pangalanes wetlands	Toamasina	✓							✓		✓
MG053	Torotorofotsy wetlands	Toamasina	✓			✓				✓		
MG054	Mantadia National Park and Analamazaotra Special Reserve	Toamasina	✓		✓	✓				✓		
MG055	Ankeniheny Classified Forest	Toamasina	✓		✓					✓		
MG056	Onive Classified Forest	Toamasina	✓		✓					✓		
MG057	Anjozorobe Forest	Antananarivo	✓		✓					✓		
MG058	Lake Itasy	Antananarivo	✓			✓				✓		
MG059	Wetlands of the Tsiribihina delta and upper Tsiribihina river	Toliara	✓					✓		✓		✓
MG060	Menabe Forest complex	Toliara	✓	✓				✓		✓		
MG061	Kirindy-South Forest complex	Toliara						✓	✓	✓		
MG062	Lake Ihotry Hunting Reserve–Mangoky Delta complex	Toliara	✓					✓		✓		✓
MG063	Mangoky–Ankazoabo Forest	Toliara							✓	✓		

Table 1 ... continued. Summary of Important Bird Areas in Madagascar. 84 IBAs covering 52,797 km²

IBA code	Site name	Administrative region	Criteria (see p. 11; for A2/3 codes see Tables 2/3)								
			A1	093	094	A2 095	096	097	A3 A14 A15	A4i	
MG064	Mikea Forest	Toliara	✓				✓	✓	✓		
MG065	Zombitse-Vohibasia National Park	Toliara	✓	✓					✓		
MG066	Analavelona Forest	Toliara	✓	✓					✓		
MG067	Saint Augustin Forest	Toliara	✓					✓	✓		
MG068	Beza Mahafaly Special Reserve	Toliara						✓	✓		
MG069	Tsimanampetsotse Strict Nature Reserve	Toliara	✓				✓	✓	✓	✓	
MG070	Mahafaly Plateau Forest complex	Toliara	✓					✓	✓		
MG071	Andohahela National Park—Parcel I	Toliara	✓		✓					✓	
MG072	Tsitongambarika Classified Forest	Toliara	✓		✓					✓	
MG073	Andohahela National Park—Parcel II	Toliara						✓	✓		
MG074	South-western coastal wetlands	Toliara	✓				✓		✓	✓	
MG075	Menarandra Forest	Toliara						✓	✓		
MG076	Lakes Anony and Erombo	Toliara	✓				✓		✓	✓	
MG077	Cape Sainte Marie Special Reserve	Toliara	✓					✓	✓		
MG078	Zafimaniry Forest	Fianarantsoa			✓					✓	
MG079	Ranomafana National Park	Fianarantsoa	✓		✓	✓				✓	
MG080	Andringitra National Park	Fianarantsoa	✓		✓	✓				✓	
MG081	Isalo National Park	Fianarantsoa	✓	✓					✓		
MG082	Vondrozo Classified Forest	Fianarantsoa	✓		✓	✓				✓	
MG083	Kalambatritra Special Reserve	Fianarantsoa	✓		✓					✓	
MG084	Midongy-South National Park	Fianarantsoa	✓		✓					✓	
Total number of IBAs qualifying:			72	19	30	11	23	10	49	35	20

(joined by man-made canals) that stretches along more than 600 km of the east coast. Most of Alaotra is now heavily polluted with fertilizers and insecticides and clogged with sediments, and what vegetation remains on the lake is mostly non-native water-fern *Salvinia* and water-hyacinth *Eichhornia*. In the west, shallow, sometimes seasonal lakes are typical, with reedbeds *Phragmites*, stretches of open and muddy shore, and much native lily-pod *Nymphaea* growth over the surface. They are often slightly alkaline and thus richer in vegetation and more productive than their eastern counterparts. Unfortunately these lakes are becoming increasingly rare, as they are much in demand by local people for conversion to rice cultivation. Particularly notable lakes in the semi-arid south-west of the island are the soda-lake of Tsimanampetsotse and the salt-lake of Ihotry. These two water-bodies appear to be the relicts of a much more extensive system of freshwater wetlands that extended from Morondava to Tolagnaro (Fort Dauphin) around 4,000 years ago. The disappearance of these wetlands had a major effect on the biodiversity of the area, with at least three species of hippopotamus and five species of bird having gone extinct.

Freshwater marshes and swamps are numerous in Madagascar. Some are very large (e.g. Torotorofotsy; Didy; south-west of Lake Alaotra), although in the east most marshes are small areas of swampy vegetation at moderate or high altitude, often in narrow valleys or on the fringes of lakes, e.g. at Vohiparara. The vegetation is 1–3 m tall and dominated by sedges *Cyperus*, reeds *Phragmites*, rushes and grasses. In inhabited areas, valley-bottom marshes are much in demand for conversion to rice cultivation and pisciculture, which has had negative impacts on their biodiversity.

Before humans colonized Madagascar c.2,000 years ago, the natural terrestrial vegetation consisted of forest and bushland. In eastern Madagascar, dense humid evergreen forest (rainforest) occupied low and medium altitudes, with sclerophyllous montane forest occurring at higher altitudes, and sclerophyllous/ericoid bushland at the highest altitudes. In western Madagascar, dry deciduous forests predominated between sea-level and 800 m elevation, although in the semi-arid south and south-west of the island this was replaced by ‘spiny forest’, a type of xerophilous woodland and bushland.

Following the arrival of humans, the clearance of primary forest and bushland (to make way for cultivation, pasture and plantations) produced secondary vegetation-types: savoka and savanna. Savoka is the dense shrubland that regenerates in fallow or abandoned areas of slash-and-burn cultivation in eastern Madagascar, at low to mid-altitudes. Savannas are man-made grasslands that now cover vast

areas on the High Plateau and in the west and south of the island. They are maintained by grazing and burning.

Of the natural terrestrial vegetation that remains in Madagascar, east Malagasy humid evergreen forest is by far the most extensive, stretching in a belt from the far south-east, just to the south-west of Tolagnaro, to just south of Iharana (Vohimar) in the north, with a narrow corridor (called the Sambirano) extending from Sambava to the west coast near Antsohihy. It still covers c.3 million hectares, of which c.80% is mid-altitude forest, between 800 m and c.1,500 m elevation. There is relatively little lowland forest left: the largest tract is around the Bay of Antongil, especially in the Masoala National Park.

Below about 600 m elevation, in lowland forest, the trees are often very tall (up to 50 m) with relatively little understorey, very abundant epiphytes (especially ferns) and little moss. The canopy is often widely separated from the understorey layer. Diversity of flowering plants is extremely high. There may be many large palms, and in areas that are somewhat degraded, many traveller’s palms *Ravenala*.

Between 600 and 800 m, with the change to mid-altitude forest, the trees become somewhat shorter (20–30 m) and are often covered in moss, especially on horizontal branches and large trunks. The gap between the understorey and the canopy diminishes, and the understorey itself becomes much denser. There is often a dense herb-layer, composed of Melastomataceae or Balsaminaceae, which may grow to 2 m in height in damp valleys. Often screw-pines *Pandanus* and tree-ferns are abundant, the former particularly on ridges. There are large numbers of epiphytes, particularly orchids and ferns. This forest-type may be found to c.1,600 m or even higher in sheltered valleys, although the transition to montane forest is lower (at c.1,200 m) on exposed ridges.

Montane forest is characterized by a low canopy, rarely more than 5–8 m, with very heavy moss growth that carpets the forest floor and most tree-limbs and trunks. Many of the canopy species are of the tree-heath family (Ericaceae). Other epiphytes are also abundant, and the herb layer, understorey and canopy merge in many places to form an almost solid wall of tangled vegetation. There may be very dense growths of parasites such as mistletoes (Loranthaceae). Also common are bamboo and, locally, tree-ferns, palms and screw-pines *Pandanus*. Almost monotypic stands of *Podocarpus* trees occur in some places, e.g. Andringitra.

Above the montane forest (above 1,600–2,000 m) there may occur sclerophyllous/ericoid bushland, essentially a dwarfed form of montane forest, up to 2 m in height. It may be interspersed with areas of grass, bamboo or bare rock, depending on exposure. In

areas where the scrub is tall, dense mats of moss may form on the ground. Good remaining examples of this vegetation-type occur on the peaks of the Marojejy, Anjanaharibe-South, Andringitra and Andohahela massifs.

West Malagasy dry deciduous forest occurs on sandy, calcareous, lateritic or more rarely ferrallitic or basaltic soils over the entire west of Madagascar, from Cape d’Ambre in the north, to south of Ihosy and Isalo, where it grades into the spiny forest of the south. Before the arrival of humans this vegetation-type probably covered an area of 13 million hectares, but it is now highly reduced and fragmented, covering only c.1.5 million hectares. Only about 55 of these remnant forest-blocks are larger than 3,500 ha, and only five are larger than 50,000 ha. The structure and plant-species composition of such forest vary somewhat as humidity and annual rainfall decline towards the south, and also vary (often more substantially) according to substrate, with forest on the calcareous ‘tsingy’ pinnacle karst being extremely stunted. However, the usual structure is that of a closed canopy, 8–20 m high, with up to 80% of trees being deciduous. Especially in the south there are many bottle-trunked trees, the best known being the baobabs *Adansonia*. There are many epiphytes, in particular lianas and orchids, although not as diverse a selection as in eastern forest. The understorey is often fairly dense (sometimes spiny) and difficult to penetrate, especially in areas near rivers. There is often very little herb layer, although carpets of *Lissochilus* orchids cover the ground in some areas.

South Malagasy spiny forest is a very particular vegetation formation, characterized in many places by the cactus-like trees of the endemic Didiereaceae family, although there are also many tree species in common with west Malagasy dry deciduous forest. The forest occurs on mostly sandy and calcareous substrates, not far from the coast, from just north of the Mangoky river in the west to just west of Tolagnaro in the east. It currently covers an area of about one million hectares. There are several different forms of this forest-type. The north-western sector, between Toliara and the Mangoky, comprises fairly tall forest, 5–15 m high, with abundant *Didierea* trees. South of Toliara and near the coast, especially on calcareous soils, *Euphorbia* forest is more common. This is shorter (2–3 m), and denser, being almost impenetrable. Towards the east and somewhat inland, the spiny forest is dominated by *Alluaudia* species, which resemble *Didierea*.

Malagasy savannas, which now cover the greater proportion—the west and the south—of the High Plateau, are dominated by non-native grass and tree species. On the High Plateau, there are only three or four species of grass over vast areas of near-sterile landscape. In the west and south, the savanna may be colonized by a few species of fire-resistant non-native trees, and there are often huge and spectacular populations of endemic palms *Bismarckia*. In some areas of the plateau, notably near Isalo and Fianarantsoa, tree-savanna with the endemic, fire-resistant tapia tree (*Uapaca bojeri*) occurs.

For more information on Madagascar’s physical and ecological environment, see the *National monograph on the biodiversity of Madagascar* (ANGAP/UNEP/ONE 1998) and Jenkins (1990).

ORNITHOLOGICAL IMPORTANCE

Madagascar split from the African continent about 150 million years ago. Since that time, well before the appearance of most modern birds, all animals have had to cross at least 200 km of open sea to reach Madagascar. This combination of random colonization from the African continent, some of it extremely ancient, and speciation from founders, has given rise to an extraordinary community of animals and plants. The birds show a very high degree of endemism, albeit still lower than in most other Malagasy vertebrate groups, birds being more mobile. The level of higher-order endemism is nonetheless unparalleled in birds—the taxonomy is contentious, but there are certainly three and possibly six families of bird that are endemic to Madagascar and the neighbouring Comoro Islands. There are 37 bird genera endemic to this region, many of which are monospecific. At the species level, 109 are endemic, out of a total of 209 breeding species. There are very few terrestrial migrant species, as Madagascar seems to be off the usual Palearctic–African flyway system.

A total of 44 species of global conservation concern occur in Madagascar (Table 4). Among African countries, only Tanzania has more such species. The 44 species comprise five Critically Endangered species, five Endangered species, 18 Vulnerable species and 16 globally Near Threatened species. All but four are strictly endemic to Madagascar, and of these four, two are otherwise only found on the Comoros (*Ardea humbloti*) and Réunion (*Circus*

Table 3. The occurrence of biome-restricted species at Important Bird Areas in Madagascar. Sites that meet the A3 criterion are highlighted in **bold**. Species of global conservation concern are highlighted in **bold blue**. Any other species with a restricted range are highlighted in blue.

A14 – West Malagasy biome (24 species in Madagascar; 49 sites meet the A3 criterion)																																	
IBA code:	001	002	003	004	005	006	007	008	009	010	011	012	013	018	019	020	021	022	023	024	025	026	027	028	030	031	032	033	034				
<i>Ardea humbloti</i>						✓			✓			✓		✓	✓		✓	✓	✓	✓	✓	✓	✓							✓			
<i>Anas bernieri</i>		✓							✓								✓			✓	✓	✓											
<i>Haliaeetus vociferoides</i>	✓		✓		✓	✓			✓		✓	✓		✓		✓		✓	✓	✓	✓	✓	✓	✓	✓				✓				
<i>Mesitornis variegata</i>				✓		✓				✓														✓									
<i>Monias benschi</i>																																	
<i>Amaurornis olivieri</i>																																	
<i>Charadrius thoracicus</i>																							✓										
<i>Coua gigas</i>																						✓	✓		✓	✓		✓	✓	✓			
<i>Coua coquereli</i>				✓		✓				✓		✓										✓	✓	✓	✓	✓	✓	✓	✓	✓			
<i>Coua cursor</i>																																	
<i>Coua ruficeps</i>																	✓					✓	✓	✓		✓		✓	✓				
<i>Coua verreauxi</i>																																	
<i>Uratelornis chimaera</i>																																	
<i>Philepitta schlegeli</i>							✓						✓											✓		✓		✓	✓	✓			
<i>Phyllastrephus apperti</i>																																	
<i>Calicalicus rufocarpalis</i>																																	
<i>Xenopirostris xenopirostris</i>																																	
<i>Xenopirostris damii</i>					✓																				✓								
<i>Falculea palliata</i>				✓		✓	✓	✓	✓	✓	✓		✓				✓					✓	✓	✓	✓	✓	✓	✓	✓	✓			
<i>Monticola imerinus</i>																																	
<i>Nesillas lantzii</i>																																	
<i>Thamnornis chloropetoides</i>																																	
<i>Newtonia archboldi</i>																																	
<i>Ploceus sakalava</i>				✓		✓		✓		✓				✓									✓	✓	✓	✓	✓	✓	✓	✓			
Number of species recorded:	1	1	1	5	1	6	2	2	4	4	1	3	2	3	1	1	4	2	2	3	7	9	9	5	6	2	6	5	5				

maillardi) and one is an intra-African migrant that breeds only in Madagascar (*Ardeola idae*).

A total of 49 species in Madagascar have a ‘restricted’ range in global terms, defined as covering less than 50,000 km² (Table 2). These species have been grouped, by their shared distributions and habitats, into five Endemic Bird Areas (EBAs)—a number of EBAs equalled in Africa only by South Africa (Stattersfield *et al.* 1998). The EBAs are not shared with any other country, and comprise the West Malagasy dry forests (EBA number 093 in Stattersfield *et al.* 1998) with six restricted-range species, the East Malagasy wet forests (094) with 20 such species, the East Malagasy wetlands (095) with seven species, the West Malagasy wetlands (096) with six species, and the South Malagasy spiny forests (097) with 10 species (Table 2).

All but one of the 28 globally threatened species also have globally restricted ranges (the exception being *Tachybaptus pelzelinii*), whereas more than half of the Near Threatened species (nine out of the 16) do not have restricted ranges and play no part in defining EBAs. It follows that 15 of the 49 restricted-range species in Madagascar are not considered of global conservation concern.

Following the floristic research of White (1983), and for the purposes of bird conservation, Madagascar can be divided into two biomes, the West Malagasy biome (number A14) and the East Malagasy biome (A15). In contrast to the rest of Africa, the two biomes of Madagascar are, in biogeographical terms, basically equivalent to the combination of forest and wetland EBAs that are found within them.

Thus the West Malagasy biome (A14) comprises the dry forest, spiny forest and western wetland EBAs, and holds 24 biome-restricted species (Table 3). Among the 24 species are 20 of the 22 restricted-range species of these EBAs (the two exceptions being *Actophilornis albinucha* of EBA 096 and *Monticola bensoni* of EBA 093). The remaining four biome-restricted species—*Coua gigas*, *C. ruficeps*, *Falcula palliata* and *Ploceus sakalava*—do not, by definition, have restricted ranges, nor are they of global conservation concern.

The East Malagasy biome comprises the wet forest and eastern wetland EBAs, and holds 45 biome-restricted species (Table 3) if one excludes *Coua delalandei* (now considered to be extinct). Among the 45 species are all of the 27 restricted-range species of these EBAs,

as well as three globally Near Threatened species. The remaining 15 species, while biome-restricted, are mostly widespread and common within the biome.

Analysing the avifauna by species’ habitat requirements, 76 of Madagascar’s 109 endemic species and 33 of the 37 endemic genera are found almost exclusively in forest. These 76 species represent 87% of all forest-limited species (89 in total) in Madagascar.

A few bird species are restricted to lowland rainforest (or at least are much commoner there than elsewhere), including *Brachypteracias squamigera*, *Coua serriana*, *Newtonia fanovanae*, *Hypositta corallirostris*, *Oriolia bernieri* and *Euryceros prevostii*. Many species of eastern forest do not occur above the upper limit of mid-altitude forest, including many terrestrial and understorey species such as *Brachypteracias leptosomus*, *Phyllastrephus madagascariensis*, *P. zosterops*, *Mystacornis crossleyi*, *Hartertula flavoviridis* and *Copsychus albospectularis*, as well as canopy-dwelling species such as *Randia pseudozosterops*, *Neomixis striatigula*, *N. tenella*, *Cyanolanius madagascarinus*, *Calicalicus madagascariensis*, *Vanga curvirostris* and *Artamella viridis* (Hawkins 1999). Several eastern-forest species only occur in higher-altitude forest, being largely absent in lowland forest. These include *Atelornis crossleyi*, *Phyllastrephus cinereiceps*, *Crossleyia xanthophrys*, *Dromaeocercus brunneus* and *Cryptosylvicola randrianasoloi*. *Neodrepanis coruscans*, common at mid-altitude, is replaced at these higher altitudes by *N. hypoxantha*. There are no species limited to montane bushland, but some (e.g. *Saxicola torquata*) may occur in this habitat when they are absent from true forest.

Four species of bird are largely or wholly restricted to western forest—*Mesitornis variegata*, *Coua coquereli*, *Phyllastrephus apperti* and *Xenopirostris damii*—and there are also some species that occur only in either western or southern forest, including *Coua ruficeps*, *C. gigas*, *Falcula palliata* and *Ploceus sakalava*.

Mesitornis benschi and *Uratelornis chimaera* are found only in the spiny forest of southern Madagascar. *Coua verreauxi*, *Monticola imerinus* and *Calicalicus rufocarpalis* are largely limited to *Euphorbia* forest. *Thamnornis chloropetoides* occurs in *Alluaudia*-dominated forest and in that to the north of Toliara, but not in coastal *Euphorbia* scrub. *Coua cursor*, *Newtonia archboldi*, *Nesillas lantzii* and *Xenopirostris xenopirostris* are found all over the south Malagasy spiny forest domain, but nowhere else.

Table 3 ... continued. The occurrence of biome-restricted species at Important Bird Areas in Madagascar. Sites that meet the A3 criterion are highlighted in **bold**. Species of global conservation concern are highlighted in **bold blue**. Any other species with a restricted range are highlighted in blue.

A14 – West Malagasy biome ... continued (24 species in Madagascar; 49 sites meet the A3 criterion)																															
IBA code:	035	036	037	038	039	043	046	058	059	060	061	062	063	064	065	066	067	068	069	070	072	073	074	075	076	077	080	081			
<i>Ardea humbloti</i>	✓	✓		✓	✓		✓	✓	✓		✓												✓		✓						
<i>Anas bernieri</i>	✓			✓	✓				✓		✓																				
<i>Haliaeetus vociferoides</i>	✓		✓	✓	✓				✓		✓																				
<i>Mesitornis variegata</i>							✓			✓																					
<i>Monias benschi</i>																															
<i>Amaurornis olivieri</i>				✓								✓																			
<i>Charadrius thoracicus</i>	✓			✓	✓				✓		✓									✓				✓							
<i>Coua gigas</i>			✓	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		
<i>Coua coquereli</i>			✓	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓															
<i>Coua cursor</i>												✓	✓				✓	✓	✓	✓	✓	✓	✓				✓				
<i>Coua ruficeps</i>			✓	✓					✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		
<i>Coua verreauxi</i>																		✓	✓	✓	✓	✓	✓	✓	✓	✓		✓			
<i>Uratelornis chimaera</i>														✓																	
<i>Philepitta schlegeli</i>			✓	✓					✓																						
<i>Phyllastrephus apperti</i>															✓	✓															
<i>Calicalicus rufocarpalis</i>																		✓			✓										
<i>Xenopirostris xenopirostris</i>													✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
<i>Xenopirostris damii</i>																															
<i>Falcula palliata</i>	✓		✓	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				
<i>Monticola imerinus</i>														✓						✓	✓			✓	✓	✓	✓				
<i>Nesillas lantzii</i>											✓			✓	✓					✓	✓			✓	✓	✓	✓				
<i>Thamnornis chloropetoides</i>											✓		✓	✓	✓					✓	✓	✓	✓	✓	✓	✓	✓				
<i>Newtonia archboldi</i>											✓		✓	✓						✓	✓	✓	✓	✓	✓	✓	✓				
<i>Ploceus sakalava</i>	✓			✓	✓				✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	
Number of species recorded:	6	1	6	11	8	1	1	1	8	7	9	5	9	12	8	3	9	8	12	12	1	8	2	7	3	6	1	1			

Table 3 ... continued. The occurrence of biome-restricted species at Important Bird Areas in Madagascar. Sites that meet the A3 criterion are highlighted in **bold**. Species of global conservation concern are highlighted in **bold blue**. Any other species with a restricted range are highlighted in blue.

A15 – East Malagasy biome (45 species in Madagascar; 35 sites meet the A3 criterion)																					
IBA code:	003	006	007	010	012	013	014	015	016	017	019	025	029	037	040	041	042	043	044	045	046
<i>Tachybaptus rufolavatus</i>																					✓
<i>Anas melleri</i>											✓	✓									✓
<i>Aythya innotata</i>																					✓
<i>Eutriorchis astur</i>							✓	✓	✓	✓			✓			✓		✓			
<i>Mesitornis unicolor</i>								✓	✓	✓			✓					✓			
<i>Sarothrura insularis</i>	✓			✓			✓	✓	✓	✓	✓		✓			✓	✓	✓	✓	✓	✓
<i>Sarothrura watersi</i>													✓	✓	✓	✓	✓				
<i>Canirallus kioloides</i>	✓							✓	✓	✓			✓	✓	✓	✓	✓				✓
<i>Rallus madagascariensis</i>									✓												✓
<i>Gallinago macrodactyla</i>							✓														✓
<i>Alectroenas madagascariensis</i>	✓	✓		✓		✓	✓	✓	✓	✓			✓		✓	✓	✓	✓	✓	✓	✓
<i>Coua serriana</i>				✓		✓		✓	✓	✓			✓		✓		✓	✓	✓	✓	✓
<i>Coua reynaudii</i>				✓	✓	✓	✓	✓	✓	✓			✓		✓	✓	✓	✓	✓	✓	✓
<i>Coua caerulea</i>		✓	✓	✓		✓	✓	✓	✓	✓			✓		✓	✓	✓	✓	✓	✓	✓
<i>Tyto soumagnei</i>	✓						✓			✓			✓								
<i>Caprimulgus enarratus</i>	✓	✓	✓				✓	✓	✓	✓			✓			✓		✓			
<i>Brachypteracias leptosomus</i>				✓		✓	✓	✓	✓	✓					✓	✓	✓	✓			✓
<i>Brachypteracias squamigera</i>				✓			✓	✓	✓						✓	✓	✓	✓			
<i>Atelornis crossleyi</i>							✓	✓	✓				✓		✓						
<i>Atelornis pittoides</i>	✓						✓	✓	✓	✓			✓			✓		✓	✓	✓	✓
<i>Philepitta castanea</i>							✓	✓	✓	✓			✓		✓	✓		✓	✓	✓	✓
<i>Neodrepanis coruscans</i>				✓			✓	✓	✓	✓			✓		✓			✓			✓
<i>Neodrepanis hypoxantha</i>							✓	✓	✓				✓		✓						
<i>Phyllastrephus zosterops</i>	✓		✓	✓		✓	✓	✓	✓	✓			✓		✓	✓	✓	✓	✓	✓	✓
<i>Phyllastrephus tenebrosus</i>									✓												
<i>Phyllastrephus cinereiceps</i>							✓	✓	✓	✓			✓					✓			✓
<i>Xenopirostris polleni</i>																✓					✓
<i>Oriolia bernieri</i>								✓	✓	✓					✓	✓		✓			✓
<i>Euryceros prevostii</i>							✓	✓	✓	✓					✓	✓		✓			✓
<i>Hypositta corallirostris</i>								✓	✓	✓			✓		✓	✓		✓	✓	✓	✓
<i>Monticola sharpei</i>	✓			✓			✓	✓	✓	✓			✓			✓		✓			✓
<i>Neomixis viridis</i>				✓			✓	✓	✓	✓			✓			✓	✓	✓	✓		
<i>Hartertula flavoviridis</i>							✓	✓	✓				✓								✓
<i>Oxylabes madagascariensis</i>	✓						✓	✓	✓	✓			✓			✓		✓			✓
<i>Crossleyia xanthophrys</i>							✓	✓	✓				✓			✓					✓
<i>Mystacornis crossleyi</i>							✓	✓	✓	✓			✓			✓		✓			✓
<i>Dromaeocercus brunneus</i>							✓	✓	✓				✓								✓
<i>Randia pseudozosterops</i>							✓	✓	✓	✓			✓			✓			✓		✓
<i>Amphilais seebohmi</i>							✓														
<i>Cryptosylvicola randrianasoloi</i>							✓	✓	✓							✓					✓
<i>Newtonia amphichroa</i>	✓			✓			✓	✓	✓	✓			✓		✓	✓		✓			✓
<i>Newtonia fanovanae</i>								✓	✓							✓					
<i>Pseudobias wardi</i>							✓	✓	✓	✓			✓			✓		✓	✓	✓	✓
<i>Ploceus nelicourvi</i>	✓					✓	✓	✓	✓	✓			✓		✓	✓	✓	✓	✓	✓	✓
<i>Foudia omissa</i>	✓						✓	✓	✓	✓			✓		✓	✓	✓	✓	✓	✓	✓
Number of species recorded:	12	3	3	12	1	6	31	35	37	29	2	1	30	1	18	28	12	27	14	27	5

Very few species of bird occur in savanna, even fewer of them being endemic to Madagascar. The most frequent among the latter group is *Mirafr hova*, which with *Cisticola cherinus* is found all over the island in savanna habitats. *Circus maillardi* occurs in savanna, albeit sparsely, and mostly on the plateau. *Margaroperdix madagascariensis*, *Turnix nigricollis*, *Pterocles personatus* and *Upupa (epops) marginata* can be found in tree-savanna, particularly in the west, where non-endemic species such as *Oena capensis* and *Numida meleagris* are also common. *Monticola bensoni* is found in areas of tapia *Uapaca* forest and rocks near Isalo, and in low-altitude tree-savanna in the south-west the local race of *Neomixis striatigula* is very common. In areas of scrubby savanna not far from primary forest, *Coua ruficeps* may be found.

In the past, Lake Alaotra was home to huge populations of waterbirds, including *Tachybaptus rufolavatus* and *Aythya innotata*, as well as colonies of *Platalea alba*, *Mycteria ibis* and many species of heron (Ardeidae). Nowadays *Tachybaptus rufolavatus* and *Aythya innotata* are on the verge of extinction, if not already extinct, while the colonies of large waterbirds are just a memory. There are

still fairly good numbers of *Anas melleri* around the lake, and *Ardea humbloti* can still be seen, but it is not clear if these species actually breed there. Few species of waterbird have been recorded from the Pangalanes, but more extensive searches might reveal a significant population of *Anas melleri*. Some eastern rivers, in particular those of the centre-east, provide suitable habitat for pairs of this species, where the rivers flow through rainforest.

Several species of bird are limited to eastern marshes. *Sarothrura watersi* is an extremely secretive bird, currently known from only two eastern marshland sites, both in or near abandoned rice-fields. However, it is probably much more widespread. *Gallinago macrodactyla*, *Rallus madagascariensis* and *Amphilais seebohmi* are widespread and are much easier to see. Other species, not limited to the habitat but common within it, are *Tachybaptus pelzelni*, *Acrocephalus newtoni* and *Saxicola torquata*.

Similarly, several species of waterbird are found nowhere else but in the western wetlands. *Amaurornis olivieri* is a close relative of *A. flavirostris* of mainland Africa, but seems strangely rare or is extremely secretive. It has only been recorded once recently, from

Table 3 ... continued. The occurrence of biome-restricted species at Important Bird Areas in Madagascar. Sites that meet the A3 criterion are highlighted in **bold**. Species of global conservation concern are highlighted in **bold blue**. Any other species with a restricted range are highlighted in blue.

A15 – East Malagasy biome ... continued (45 species in Madagascar; 35 sites meet the A3 criterion)																					
IBA No:	047	048	049	050	051	052	053	054	055	056	057	058	066	071	072	078	079	080	082	083	084
<i>Tachybaptus rufolavatus</i>																					
<i>Anas melleri</i>				✓	✓	✓	✓					✓					✓	✓	✓	✓	
<i>Aythya innotata</i>																					
<i>Eutriorchis astur</i>	✓				✓			✓													
<i>Mesitornis unicolor</i>	✓	✓	✓									✓			✓		✓	✓		✓	
<i>Sarothrura insularis</i>	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
<i>Sarothrura watersi</i>							✓										✓				
<i>Canirallus kiolooides</i>	✓	✓	✓		✓			✓	✓	✓	✓			✓	✓		✓	✓	✓	✓	
<i>Rallus madagascariensis</i>				✓			✓	✓									✓				
<i>Gallinago macrodactyla</i>				✓			✓	✓			✓	✓					✓	✓	✓	✓	
<i>Alectroenas madagascariensis</i>	✓	✓	✓		✓		✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	
<i>Coua serriana</i>	✓	✓	✓		✓			✓			✓										
<i>Coua reynaudii</i>	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	
<i>Coua caerulea</i>	✓	✓	✓		✓		✓	✓	✓	✓	✓			✓		✓	✓	✓	✓	✓	
<i>Tyto soumagnei</i>	✓							✓													
<i>Caprimulgus enarratus</i>	✓	✓	✓					✓	✓						✓		✓			✓	
<i>Brachyteracias leptosomus</i>	✓	✓	✓		✓			✓	✓	✓	✓			✓				✓	✓	✓	
<i>Brachyteracias squamigera</i>	✓	✓			✓			✓						✓	✓		✓	✓	✓	✓	
<i>Atelornis crossleyi</i>	✓		✓		✓			✓		✓	✓			✓			✓	✓		✓	
<i>Atelornis pittoides</i>	✓	✓	✓		✓		✓	✓	✓	✓	✓			✓		✓	✓	✓	✓	✓	
<i>Philepitta castanea</i>	✓	✓	✓		✓			✓	✓	✓	✓			✓		✓	✓	✓	✓	✓	
<i>Neodrepanis coruscans</i>	✓	✓	✓		✓			✓	✓	✓	✓			✓		✓	✓	✓	✓	✓	
<i>Neodrepanis hypoxantha</i>	✓											✓		✓			✓	✓			
<i>Phyllastrephus zosterops</i>	✓	✓	✓		✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	
<i>Phyllastrephus tenebrosus</i>	✓																				
<i>Phyllastrephus cinereiceps</i>	✓		✓					✓		✓	✓			✓		✓	✓	✓		✓	
<i>Xenopirostris polleni</i>	✓	✓							✓					✓			✓	✓		✓	
<i>Oriolia bernieri</i>	✓	✓	✓		✓																
<i>Euryceros prevostii</i>	✓	✓						✓													
<i>Hypositta corallirostris</i>	✓		✓		✓			✓	✓	✓				✓	✓		✓	✓	✓	✓	
<i>Monticola sharpei</i>	✓	✓	✓		✓			✓	✓	✓	✓			✓			✓	✓	✓	✓	
<i>Neomixis viridis</i>	✓	✓	✓		✓		✓	✓	✓	✓	✓		✓	✓			✓	✓	✓	✓	
<i>Hartertula flavoviridis</i>	✓		✓					✓						✓			✓	✓		✓	
<i>Oxylabes madagascariensis</i>	✓	✓	✓		✓		✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	
<i>Crossleyia xanthophrys</i>					✓			✓	✓	✓	✓			✓		✓	✓	✓	✓	✓	
<i>Mystacornis crossleyi</i>	✓	✓			✓			✓	✓		✓			✓		✓	✓	✓	✓	✓	
<i>Dromaeocercus brunneus</i>	✓							✓	✓	✓	✓			✓		✓	✓	✓		✓	
<i>Randia pseudozosterops</i>	✓	✓	✓		✓			✓	✓	✓	✓			✓			✓	✓		✓	
<i>Amphilais seebohmi</i>					✓			✓								✓	✓	✓			
<i>Cryptosylvicola randrianasoloi</i>	✓							✓		✓	✓			✓				✓		✓	
<i>Newtonia amphichroa</i>	✓	✓	✓		✓		✓	✓	✓	✓	✓			✓		✓	✓	✓	✓	✓	
<i>Newtonia fanovanae</i>	✓							✓						✓					✓		
<i>Pseudobias wardi</i>	✓	✓	✓		✓		✓	✓	✓	✓	✓			✓		✓	✓	✓	✓	✓	
<i>Ploceus nellicourvi</i>	✓	✓	✓		✓		✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	
<i>Foudia omissa</i>	✓	✓	✓		✓			✓	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓	
Number of species recorded	37	26	26	3	28	2	15	35	25	24	28	3	4	31	9	18	34	33	22	23	28

Lake Bemamba near Antsalova. *Anas bernieri* is less secretive than *Amaurornis olivieri*, but is probably much more threatened. It seems unlikely that there are more than 500 of this attractive small duck left. They are restricted to an area between Morondava and Mahajanga, where they breed in holes in large mangrove trees and feed on mudflat edges and muddy lake-fringes. *Ardea humbloti* is a large and rather rare species, usually found singly on lake shores or estuaries.

As with wetlands, Malagasy coastal habitats differ between the west and the east. The tradewind-battered east coast is mostly sand beaches, with little birdlife apart from a few seabird colonies on offshore islands and a trickle of Palearctic migrant waders on the small estuaries. A very patient seawatcher from Cape Sainte Marie (the southernmost point of Madagascar) or from Libanona might see some petrels or albatrosses.

The west coast is much richer and more diverse, with very extensive mangroves, salt pans, coastal lagoons, estuaries, sandbars, sand beaches, and offshore islands, both rocky and sandy. From Cape Sainte Marie to about Morondava, there are a few coral reef

islands with breeding seabirds, notably a colony of *Phaethon rubricauda* on Nosy Ve near Toliara, a huge colony of *Sterna dougallii* on Nosy Manitra south-west of the same town, and a few pairs of *Puffinus pacificus* on islands off Morombe. The coast in this region is mostly sandy, with muddy inlets producing some stunted mangrove patches such as at the mouth of the Onilahy. The first major estuary going north is the Mangoky and, like the Tsiribihina and Manambolo further north, it frequently holds large populations of flamingos (Phoenicopteridae). There are quite large areas of rather barren saltflats near Belo-sur-Mer and Belo-sur-Tsiribihina, where now and again the enigmatic *Anas bernieri* may be found.

Further north again, there are more small or medium-sized islands, including the Iles Barren, whose large phosphate deposits indicate that at some point in the past there must have been substantial populations of breeding seabirds. There appear to be relatively few there nowadays, however. On the coast itself, there are a few narrow muddy inlets holding migrant *Dromas ardeola* and wintering Palearctic waders, and some thin strips of mangrove that appear to hold a relict breeding population of *Anas bernieri*.

Along the east–west coastal stretch between Cape Saint Augustin and Mahajanga are two of the most productive and interesting estuaries in Madagascar, the Mahavavy and the Betsiboka. Both regularly hold *Anas bernieri*, probably mostly while feeding in the non-breeding season, and this appears to be one centre of distribution of the rather rare *Threskiornis (aethiopicus) bernieri*. The Mahavavy holds one of the largest concentrations of flamingos in Madagascar, while the Betsiboka may support the largest congregation of Palearctic waders on the island. The most common species are *Charadrius leschenaultii* and *Calidris ferruginea*.

Between Mahajanga and Nosy Be there are few coastal areas of major importance for birds, with the possible exception of the Mahajamba estuary which sometimes holds a few *Anas bernieri*. The islands between Nosy Be and Cape d’Ambre hold the majority of the breeding seabirds of Madagascar as well as a substantial percentage of the world population of *Haliaeetus vociferoides*. The most common breeding seabirds are *Sterna bergii* and *S. fuscata*, in the northern part of this area, and *Sula leucogaster*, *Fregata minor* and *F. ariel* which breed on one or two of the Quatre Frères group, just south of Nosy Mitsio. *Sterna dougallii*, *Anous stolidus* and *A. tenuirostris* probably breed on the more remote sandy islands north of Cape St Sébastien. Such is the pressure of local people on breeding seabirds in this area that birds only breed in the south on islands on which it is impossible to land. In the north they are protected during the breeding season (July–August) by the strong but fickle ‘varatraza’ tradewind, which blows offshore, making a journey out to remote islands easy but the return especially hazardous for the local sailing outriggers.

Table 4. The 44 species of global conservation concern that occur regularly in Madagascar (Collar *et al.* 1994). The 28 globally threatened species are highlighted in **bold**.

Name	Global threat status
<i>Tachybaptus rufolavatus</i>	Critically Endangered
<i>Tachybaptus pelzelni</i>	Vulnerable
<i>Ardea humbloti</i>	Vulnerable
<i>Ardeola idae</i>	Near Threatened
<i>Lophotibis cristata</i>	Near Threatened
<i>Phoenicopterus minor</i>	Near Threatened
<i>Anas melleri</i>	Near Threatened
<i>Anas bernieri</i>	Endangered
<i>Aythya innotata</i>	Critically Endangered
<i>Haliaeetus vociferoides</i>	Critically Endangered
<i>Eutriorchis astur</i>	Critically Endangered
<i>Circus maillardi</i>	Near Threatened
<i>Accipiter madagascariensis</i>	Near Threatened
<i>Accipiter henstii</i>	Near Threatened
<i>Mesitornis variegata</i>	Vulnerable
<i>Mesitornis unicolor</i>	Vulnerable
<i>Monias benschi</i>	Vulnerable
<i>Sarothrura watersi</i>	Endangered
<i>Amaurornis olivieri</i>	Critically Endangered
<i>Charadrius thoracicus</i>	Vulnerable
<i>Coua verreauxi</i>	Near Threatened
<i>Tyto soumagnei</i>	Endangered
<i>Brachypteracias leptosomus</i>	Vulnerable
<i>Brachypteracias squamigera</i>	Vulnerable
<i>Atelornis crossleyi</i>	Vulnerable
<i>Atelornis pittoides</i>	Near Threatened
<i>Uratelornis chimaera</i>	Vulnerable
<i>Philepitta schlegeli</i>	Near Threatened
<i>Neodrepanis hypoxantha</i>	Endangered
<i>Phyllastrephus apperti</i>	Vulnerable
<i>Phyllastrephus tenebrosus</i>	Endangered
<i>Phyllastrephus cinereiceps</i>	Vulnerable
<i>Xenopirostris damii</i>	Vulnerable
<i>Xenopirostris polleni</i>	Vulnerable
<i>Oriolia bernieri</i>	Vulnerable
<i>Euryceros prevostii</i>	Near Threatened
<i>Monticola sharpei</i>	Near Threatened
<i>Monticola bensoni</i>	Vulnerable
<i>Hartertula flavoviridis</i>	Near Threatened
<i>Crossleyia xanthophrys</i>	Vulnerable
<i>Dromaeocercus brunneus</i>	Near Threatened
<i>Randia pseudozosterops</i>	Near Threatened
<i>Newtonia fanovanae</i>	Vulnerable
<i>Pseudobias wardi</i>	Near Threatened

CONSERVATION INFRASTRUCTURE AND PROTECTED-AREA SYSTEM

Since the colonial period, administrative, legal and technical measures have been developed and implemented to control the degradation and destruction of habitats and to preserve biological diversity in Madagascar, including measures to protect ecosystems and species. Such measures have included the development of a national protected-area system, as well as the enactment of regulations to manage forests rationally (Regulation No. 25/SE/FOR/SEG of 14 January 1957 on the Protection of Forests in Madagascar) and to control bush-fires, forest clearance and soil erosion (Regulation No. 60-127 of 3 October 1960, Regulation No. 76-030 of 21 August 1976, and Presidential Decree No. 84-445).

As part of its development programme initiated in the mid-1980s, Madagascar committed itself to an ambitious effort to achieve sustainable environmental management. The country developed a 15-year National Environmental Action Plan (NEAP), the first of its kind in Africa. The NEAP was given legal recognition by the adoption of the National Environment Charter and the National Environmental Policy (Law No. 90-033, 21 December 1990).

Over the last decade, the environmental sector has grown steadily in importance and has gained great recognition by government leaders and the public, despite the socio-economic and political uncertainty in the country. All national environmental activities now fall within the framework of the NEAP, which is an attempt to ensure consistency between the various intervening national and international parties.

The NEAP is divided into three phases. The first phase (EP1: 1991–1997) concentrated on:

- Institutional reinforcement of three existing entities:
 - the Ministry of Water and Forests (MEF, Ministère des Eaux et Forêts), responsible for the development of forest and natural resources policy, the supervision of forest management and the enforcement of forestry legislation;
 - the National Geographical and Hydrographic Institute (FTM), responsible for setting up and developing the cartographic base;
 - the land-tenure administration (Direction des Domaines).
- Institutional development, through the creation of three new entities:
 - the National Office for the Environment (ONE, Office National pour l’Environnement), responsible for the coordination and implementation of the NEAP, the promotion of policies and legislation, the coordination of environmental surveys and awareness, education and training activities, as well as the management of environmental data;
 - the National Association for the Management of Protected Areas (ANGAP, Association Nationale pour la Gestion des Aires Protégées), responsible for the management of protected areas, directly or with the assistance of operators;
 - the National Association for Environmental Actions (ANAE, Association Nationale d’Actions Environnementales), responsible for financing the preparation and implementation of micro-projects on soil and watershed management.
- Actions in the areas of watershed and soil conservation, forest management, land tenure improvement, increased cartographic capacity and production of aerial photographs.
- Development and management of protected areas, notably through Integrated Conservation and Development Projects (ICDPs).
- Policy formulation and improvement of the regulatory framework, notably through: adoption of legislation on environmental impact assessments; development of a new forestry policy translated into legislation providing for decentralization of forest management and rationalization of management plans and logging permits; and adoption of a law on natural resource management by local communities under negotiated contractual arrangements that spell out the management system and allocation of revenues.

The second phase of the NEAP (EP2) started in July 1997 and was developed through a nationwide participatory process. The

increasing poverty of the Malagasy population has had a significant impact on the approach adopted by EP2, which more fully integrates development at a broader regional scale. EP2 is divided into three components:

- Field operations, which will take up c.90% of the total programme cost.
- Strategic activities destined to upgrade the legal framework, formulate environmental policies and assist sector ministries in implementing policies and making environmental impact assessments operational.
- Support activities such as research, communications/education/training, data development and analysis with Geographic Information Systems, and monitoring and evaluation.

Field operations include, among other components:

- Specialized sub-sectoral activities:
 - Multiple-use Forest Ecosystem Management (ESFUM, Ecosystèmes Forestiers à Usages Multiples): the objective of this component is the implementation of the new forest policy which calls for the gradual transfer of responsibility for natural resource management to local communities. Placed under the responsibility of MEF, this process includes the development and implementation of participatory management plans involving local communities.
 - National Parks and Ecotourism Development (CAPE, Composante Aires Protégées et Ecotourisme): the objective is to complete the establishment of the protected-area network, provide infrastructure, equipment and staff to ensure effective conservation, promote the development of ecotourism, establish and monitor meaningful ecological indicators, promote environmental awareness and strengthen environmental education around protected areas. This component is under the responsibility of ANGAP, which is gradually taking over direct management of protected areas.
 - Marine and Coastal Ecosystems (EMC, Ecosystèmes Marins et Côtiers): the objective is to formulate coastal zone management policies and an enabling legal framework, to increase local and regional responsibility and capacity for management, and to promote the Integrated Coastal Zone Management (ICZM) process.
- Generic mechanisms to support local management of natural resources and the regionalization process:
 - Support to Local Resources Management and Land Tenure (GELOSE, Gestion Locale Sécurisée). This component has two objectives. First, to redefine management policies for the long term, and, second, to enable transfer of management rights of public land, on a voluntary basis, from the state to village communities. This transfer is to be achieved through the signing of an agreement between state representatives and village members, negotiated with the assistance of environmental mediators.
 - Support to Regional Programming and Spatial Analysis (AGERAS, Appui à la Gestion Régionalisée et à l'Approche Spatiale): the underlying idea to this component, under the responsibility of ONE, is that ICDPs developed in the peripheries of parks and reserves, while demonstrating the linkage between conservation and development, are not sufficiently addressing the various pressures on the areas in question. The regional approach therefore aims at linking activities in priority zones to threats, opportunities and development needs in a broader landscape. This analysis results in a multi-level (national, regional and local) and multi-sector (NGOs, associations, governmental authorities and local populations) approach dealing with a variety of factors (infrastructure, soil, watersheds, corridors, etc.).

The current protected-area system consists of areas of public land that have been gazetted by decrees or regulations, according to the seven categories below:

- Strict Nature Reserve (Réserve Naturelle Intégrale)—10 in number, covering a total surface area of 346,302 ha, with the objective of protecting fauna and flora.
- Special Reserve (Réserve Spéciale)—23 in number, covering a total surface area of 381,089 ha, with the objective of protecting natural ecosystems or specific animal species.

- National Park (Parc National)—15 in number, covering a surface area of 1,122,548 ha, with the objective of protecting and conserving the original fauna and flora and offering educational and recreational opportunities (ecotourism).
- Hunting Reserve (Réserve de Chasse)—four in number, although their surface area is not precisely defined. Their objective is to protect fauna, and the right to hunt is suspended.
- Classified Forest (Forêt Classée) and Forestry Reserve—258 in number, covering some 4,000,000 ha, with the objective of protecting watersheds and/or constituting forestry reserves in the traditional economic sense. Forest exploitation is allowed or prohibited by decree, except for the use-rights of neighbouring populations.
- Reforestation or Restoration Area—101 in number, covering 1,044,895 ha, with the objective of protecting watersheds and limiting soil erosion. The exploitation of land is controlled and an appropriate management policy is implemented (ZODAFARB—Zone d'Action en Faveur de l'Arbre—Area of Action for the Protection of Trees).
- Forestry Station—23 in number, covering approximately 57,294 ha (data from IEFN).

Until recently, the concept of zoning an area for different management objectives was practically unused in Madagascar and, therefore, few management plans have so far been drawn up for areas of national conservation importance, such as the existing protected areas. Those areas which do now have proper management plans include:

- Those protected areas where integrated conservation and development projects (ICDPs) have already been initiated.
- Five recently created National Parks: Kirindy/Mite, Baly Bay, Midongy-South, Marojejy and Andringitra.
- Some ongoing site-based development projects, e.g. the Project on Forest Development in Vakinankaratra, and the CFPF Project in the Menabe area.
- Four Classified Forests, these being pilot areas for the COEFOR Project (Contribution to the Study of Classified Forests), which aims to implement management plans, with the participation of neighbouring populations, at all Classified Forests.
- The village forests linked to the CAF Project (Forest Support Unit).

INTERNATIONAL MEASURES RELEVANT TO THE CONSERVATION OF SITES

The Malagasy Government has ratified the Convention on Biological Diversity, CITES, World Heritage Convention, Ramsar Convention, Convention to Combat Desertification, Convention on Climate Change and the African Convention on the Conservation of Nature and Natural Resources, and is an active participant in the UNESCO Man and Biosphere Programme. The only World Heritage Site in Madagascar is Bemaraha Tsingy (IBA MG037). Two sites have been designated as Ramsar Sites—Tsimanampetsotse Strict Nature Reserve (IBA MG069) and the Manambolomaty wetland complex (IBA MG039)—and one site has been designated as a Biosphere Reserve, Mananara-North National Park (IBA MG042). The Government is currently examining the possibility of designating some marine sites as further Biosphere Reserves.

OVERVIEW OF THE INVENTORY

This inventory is the result of a 29-month collaboration between the National Association for the Management of Protected Areas (ANGAP), the Ministry of Water and Forests (MEF) and BirdLife International. This collaboration, the ZICOMA Project (Zones d'Importance pour la Conservation des Oiseaux à Madagascar), is intended to highlight those sites for which action is urgently required in order to conserve the remarkable and endemic bird fauna of Madagascar. It is a direct result of the national workshop on 'Priorities for Biodiversity Conservation' in 1995 (*Primate Report Special Issue* 48(1), June 1997).

Data for the inventory of Important Bird Areas (IBAs) were gathered from two main sources. Firstly, a literature review was conducted, as described in more detail in ZICOMA (1999). These

data were then compiled into the accounts for each site. Secondly, the field team of the ZICOMA Project visited a large number of sites, sometimes in collaboration with other agencies. Field visits and methodology are described in more detail in ZICOMA (1999). Up-to-date information was collected on habitats, land-uses, threats, birds and other wildlife present at the site, and added to the information collected from the literature. The results were published as a national IBA inventory (ZICOMA 1999).

As a result, a total of 84 Important Bird Areas (IBAs) were identified in Madagascar (Map 1, Table 1), occupying 52,797 km², equivalent to c.8.6% of the land area of Madagascar. Another 17 sites were analysed against the IBA-selection criteria, but did not qualify: Lokobe Strict Nature Reserve; Ambohitantely Special Reserve; Ambohijanahary Special Reserve; Manombo Special Reserve; Berenty Private Reserve; Antsiraka Classified Forest; Antsakoamileka Forest; Manambolo-Tsiribihina Forest; Manjakatampo Forest Station; south Pangalanes wetlands; Ankazomivady complex; Lakato Classified Forest; Tongay Classified Forest; Ambereny Classified Forest; islands near Toamasina; Kianjavato, Vatovavy Forest; Upper Mananjary Forest.

Of the 84 IBAs, 48 are unprotected legally, the majority of them wetlands. However, 12 of these do have some conservation activity in place or planned. Of the 36 formally protected IBAs, four have no practical enforcement.

The IBAs are distributed all over the island, with the exception of the High Plateau (see Map 1), with concentrations in the centre-east, north-west and north. These concentrations reflect the distribution of species-rich natural habitats (wetlands and forests), but also a tendency for sites that are well studied to have longer species-lists and thus be more likely to qualify as IBAs. This tendency is particularly marked in eastern Madagascar, where certain protected areas (Marojejy National Park, Anjanaharibe-South Special Reserve, Zahamena National Park, Andringitra National Park, Andohahela National Park) have been the subject of detailed bird inventories. There is, however, no evidence to suggest that these sites are much more species-rich (at least for birds) than unprotected sites nearby. In the wet forests, the fact that unprotected sites or Classified Forests (considered here as unprotected for biodiversity) contain fewer species than protected sites (Special Reserves, Strict Nature Reserves, National Parks) simply reflects that fact that the only coverage of the majority of unprotected sites has been a short visit by the team of the ZICOMA Project. Indeed, in wet forests only one species of bird was found solely in protected areas, *Phyllastrephus tenebrosus*, a species that seems to be very difficult to detect.

Thus, for sites in wet forests it should not be presumed that this list of IBAs includes all the sites that would qualify as IBAs, were more fieldwork to be done. The same caveat applies to the eastern wetlands, which are distributed very widely but sparsely, and where it seems very likely that there are more sites to be discovered. For dry forests, spiny forests and western wetlands, it is probable that the list here includes the great majority of sites that would qualify as IBAs.

A total of 72 sites qualify as IBAs under the A1 criterion, holding a significant number of one or more of the 44 species of global conservation concern in Madagascar. Among these species, those that are endemic to Madagascar, and present at very few sites, yet are not restricted-range species (and thus are not considered under the A2 criterion), are particularly noteworthy. Among such species, *Circus maillardi*, *Accipiter madagascariensis* and *Tachybaptus pelzelni* are the three that are found at the fewest sites. *Circus maillardi* occurs at 13 IBAs, but is never abundant and deserves further research. *Accipiter madagascariensis* is found at 24 IBAs, but its identification causes major problems and it is likely that it is better distributed. *Tachybaptus pelzelni* is found everywhere on the island, but its genetic integrity is probably threatened by hybridization with *Tachybaptus ruficollis*, and it should therefore be studied further, as suggested by Langrand and Goodman (1996). Among the other endemic and widespread species that are nevertheless of global conservation concern, the population of *Ardeola idae*, even if it is well distributed, seems to be decreasing, and research will have to be conducted, especially on breeding colonies.

Each of the 84 IBAs in Madagascar lies within at least one of the five Endemic Bird Areas. A total of 19 sites lie within the West Malagasy dry forests EBA (covering 9,500 km², 14% of the total

IBA area), 30 sites within the East Malagasy wet forests EBA (18,000 km², 29%), 18 sites within the East Malagasy wetlands EBA (1,410 km², 2%), 32 sites within the West Malagasy wetlands EBA (21,000 km², 34%) and 11 sites within the South Malagasy spiny forests EBA (13,000 km², 21%). Not all of the sites actually support a good complement of restricted-range species for the relevant EBA, but the great majority of them, 75 sites, do in fact support good species assemblages for one or two EBAs, and thus qualify under the A2 criterion (Table 2).

All 19 sites in the West Malagasy dry forests EBA meet the A2 criterion. The bird communities at these IBAs are relatively heterogeneous. Some restricted-range species have very patchy distributions, therefore not all forest blocks, even when large, have a similar-sized complement of species. The six dry-forest sites with the largest species-complements are Ankarafantsika Strict Nature Reserve and Ampijoroa Forestry Station (IBA MG027), Ankarana Special Reserve (MG006), Analamera Special Reserve (MG004), Analavelona Forest (MG066), Menabe Forest complex (MG060) and Zombitse-Vohibasia National Park (MG065), each of which holds at least three out of the six restricted-range species characteristic of this EBA. The first three sites contain both *Xenopirostris damii* and *Mesitornis variegata*. Analavelona and Zombitse-Vohibasia contain the only populations known of *Phyllastrephus apperti*. Menabe Forest complex holds a large population of *Mesitornis variegata*. In addition, the dry-forest site of Bemaraha Tsingy National Park and Strict Nature Reserve (MG037) holds populations of two undetermined taxa (*Monticola* sp. and *Canirallus* sp.) which may be endemic to the massif (and therefore with a highly restricted range)—research to clarify their taxonomic status is a high priority.

Of the six 'top' IBAs of the dry forests EBA, only Analavelona Forest has no formal protection and no conservation activities currently in progress. It should thus be regarded as a very high priority for conservation action and further inventories, to confirm the presence of wet-forest species detected during the ZICOMA field-team visit. A relatively large area of dry forest to the east of Port-Bergé and Antsohihy only came to the notice of the ZICOMA Project after the fieldwork phase of the project was over. It is very likely that this area of forest holds many important bird species, and inventory work in the area is of the highest priority.

Turning to the East Malagasy wet forests EBA, all 30 sites within the EBA meet the A2 criterion. The distribution of bird communities within the EBA shows strong variation with altitude (Hawkins and Goodman 1999). Thus, the sites with the greatest number of restricted-range species are those that hold forest at a variety of different altitudes (lowland, mid-altitude and montane), as well as those that are the best known ornithologically. Consequently, the top five sites are Zahamena National Park (IBA MG047), Marojejy National Park (MG016), Anjanaharibe-South Special Reserve (MG015), Mantadia National Park and Analamazaotra Special Reserve (MG054) and Andohahela National Park—Parcel I (MG071), each of which holds at least 13 out of the 20 restricted-range species characteristic of this EBA. Only one of these sites (Andohahela) lies in the south of the EBA, where certain 'northern' restricted-range species do not occur (e.g. *Eutriorchis astur*, *Tyto soumagnei*, *Coua serriana*, *Oriolia bernieri* and *Euryceros prevostii*), and where species-complements are thus generally not so high.

The differences between the top five sites can be related to the presence or absence of the following restricted-range species: *Eutriorchis astur*, *Tyto soumagnei*, *Oriolia bernieri*, *Newtonia fanovanae*, *Xenopirostris polleni* and *Phyllastrephus tenebrosus*. These species may well be present in all low- and mid-altitude forest IBAs in the northern half of the rainforest belt, but because they are difficult to detect and may be present at low densities, the number of sites where they are known to occur is low. The only wet-forest bird species with a very restricted distribution is *Mesitornis variegata*. It is known only from Ambatovaky Special Reserve (MG043) and it seems likely that this population is different at some taxonomic level from the populations found at its other five sites in western Madagascar. A very high priority for research is to evaluate this question.

There are many conservation projects in place in the wet forests. These include Masoala National Park (IBA MG017), Marojejy National Park (MG016), Mananara-North National Park (MG042), Anjanaharibe-South Special Reserve (MG015), Zahamena National Park (MG047), Ranomafana National Park

(MG079), Andringitra National Park (MG080) and Andohahela National Park (MG071 and MG073). The only species of wet-forest bird not recorded from any active conservation project site is the wet-forest population of *Mesitornis variegata*, as noted above. The very large area of wet forests to the east of Maroantsetra, north of Zahamena National Park, and including Ambatovaky Special Reserve (MG043), Upper Rantabe Classified Forest (MG041), Anjanaharibe Classified Forest (MG040), Marotandrano Special Reserve (MG029), Bezavona Classified Forest (MG045) and Bidia Classified Forest (MG044), is probably the centre of distribution of most wet-forest species. It is the largest intact block of forest in Madagascar, and the furthest from access points. It is not known how much habitat alteration has already occurred in this forest, but the level is likely to be low. Inventory research and community-based conservation action are a high priority in this area.

For the conservation of the East Malagasy wetlands EBA, the five most important sites among the 11 that meet the A2 criterion are Lake Alaotra (MG046), Torotorofotsy wetlands (MG053), Ranomafana National Park (MG079) and Mantadia National Park and Analamazaotra Special Reserve (MG054), each of which holds at least three out of the seven restricted-range species characteristic of this EBA. Several of these species are known from only a few sites. It is, however, very likely that most of the species, especially those such as *Sarothrura watersi* that are very difficult to detect, are present in a much larger number of sites. This leaves Lake Alaotra as by far the most important site for conservation of restricted-range birds in this EBA, owing to the presence of two species that have not been recorded regularly from anywhere else in the world, *Tachybaptus rufolavatus* and *Aythya imotata*. Although their continued survival at Lake Alaotra is in grave doubt, as neither has been seen at the lake for at least 10 years, it is still possible that the two species may occur in lakes and marshes in the surrounding area. However, recent fieldwork (Hawkins *et al.* 2000) failed to find evidence of either species on or near the lake and they may both now be extinct.

Lake Alaotra is also still the most important site for another restricted-range species, *Anas melleri*, as groups of several hundred birds have been seen there recently. No other site in Madagascar regularly holds more than 50 birds. Conservation management at the lake should thus endeavour to reduce hunting levels of this species, to preserve this key population. Other species characteristic of this EBA are those found in marshes with low vegetation, which are no longer very abundant at Lake Alaotra. In particular, *Sarothrura watersi* is known currently from only two sites, including the most important area of low marshland in Madagascar, Torotorofotsy. There is an initiative in place to conserve Torotorofotsy, which is gravely threatened by a planned mine. However, as noted above, it is certain that other sites not described here will contain the rare marsh species. There are some marsh areas deep in rainforest that have never been visited by researchers. A survey to identify these sites, and search for the rare bird species that they probably contain, is a high priority.

In the West Malagasy wetlands EBA, the six most important sites out of the 23 that meet the A2 criterion are the Bemamba wetland complex (MG038), Lake Ihotry Hunting Reserve–Mangoky Delta complex (MG062), Tambohorano wetlands (MG035), Baly Bay National Park (MG026), Manambolomaty wetland complex and Tsimembo Classified Forest (MG039) and the wetlands of the Tsiribihina delta and upper Tsiribihina river (MG059), each of which holds at least four out of the six restricted-range species characteristic of this EBA. The restricted-range species that make these sites particularly important are *Anas bernieri* and *Amaurornis olivieri*. The only place at which the latter species has been recorded recently is Lake Bemamba. It has also been recorded, but a long time ago, from the Mahavavy delta wetlands (MG025) and the Lake Ihotry Hunting Reserve–Mangoky Delta complex. Fieldwork to relocate this species at these sites and at other potential sites such as Tambohorano wetlands is a very high priority. *Anas bernieri* is clearly a very threatened species, for which population estimates are very low. A complete survey of all sites that might hold the species would permit an accurate population estimate. Other rare species in western wetlands include *Haliaeetus vociferoides* and *Ardea humbloti*. Both these species could also be counted in an aerial survey. *Ardea humbloti* is particularly threatened as it nests colonially, often in company with *Threskiornis (aethiopicus) bernieri*. Surveys to identify and protect breeding colonies of these two species are a very high

priority. *Charadrius thoracicus* seems to be fairly common where it occurs, particularly in the south, but never abundant. A study to estimate its population size is a priority, as is a study to evaluate its ecological relationship with *Charadrius pecuarius*.

In the South Malagasy spiny forests EBA, the majority of the 10 sites that qualify under the A2 criterion share most of their restricted-range species, since only a few restricted-range species have a patchy distribution within the EBA. The three most important sites for this EBA are the Mikea Forest (MG064), Mahafaly Plateau Forest complex (MG070) and Tsimanampetsotse Strict Nature Reserve (MG069), each of which holds at least seven out of the 10 restricted-range species characteristic of this EBA. The most important restricted-range species, in conservation terms, are those with very limited distributions, namely *Uratelornis chimaera*, *Monias benschi* and *Calicalicus rufocarpalis*. The first two are only found in the Mikea Forest. Both are monotypic genera in families endemic to Madagascar. The Mikea Forest contains no protected areas and is under immediate and substantial threat from charcoal-burning and shifting cultivation. In bird conservation terms, therefore, the Mikea Forest could be regarded as the highest priority site in Africa, and one of the highest in the world. The development of a community-based forest-conservation programme, in an area with high population levels of both species, a willingness on the part of the local people for forest-conservation initiatives and, preferably, some potential for ecotourism, is thus of extremely high priority.

The area of distribution of *Calicalicus rufocarpalis* coincides to a considerable degree with that of *Coua verreauxi*, with the former seeming less common than the latter. Both are found in coastal *Euphorbia* scrub, which is not yet very threatened, but surveys to clarify the range of both species, particularly in the area of Cape Sainte Marie Special Reserve (MG077) and further to the east, are a priority.

A total of 49 sites individually hold a good complement of species characteristic of the West Malagasy biome, thus meeting the A3 criterion. Similarly, 35 sites meet the A3 criterion for the East Malagasy biome. No sites were designated as qualifying as IBAs solely under the A3 criterion, as the suites of sites identified under the A2 criterion already support the full range of A3 species. Those biome-restricted species which are not also of global conservation concern (A1) and/or possessing a restricted range (A2), are generally present at many more IBAs than the A1/A2 species. The only striking exception to this is the nocturnal *Caprimulgus enarratus*, which is rather difficult to detect as its call is not known, and which may have been missed on the majority of ZICOM field missions. However, it seems to be present at almost all sites where sufficient time has been spent on surveys, and it has so far been found at 51% of sites within the East Malagasy biome. *Mystacornis crossleyi* is only known from 57% of sites in the East Malagasy biome, but it is also a discreet species that may be difficult to detect if the call is not known. All other A3 species (that are not also A1/A2) occur at more than 60% of the IBAs of the East Malagasy biome. In the West Malagasy biome, all purely A3 species occur in more sites than the A1/A2 species, except that three A1/A2 species are particularly dispersed and widespread (*Ardea humbloti*, *Haliaeetus vociferoides* and *Coua coquereli*). Thus it is not necessary to select any further IBAs within this biome.

A total of 20 sites qualify as IBAs under the A4i criterion, holding significantly large congregations of one or more of the 47 Malagasy waterbird species that are considered eligible under the criterion. Nearly all such sites are western wetlands. Migrant species of wader are most abundant in the Mahavavy delta wetlands (IBA MG025), Bombetoka Bay and Marovoay wetlands (MG024) and Ambavanankarana wetlands (MG009). The numbers of individuals involved are generally not high and there are relatively few conservation risks. However, for breeding species of seabirds, there are several colonies of major importance, in particular for *Sterna dougallii*. Madagascar may hold 10% of the world population of this species. Its colonies are in the Cape Anorontany archipelago (IBA MG001; not yet definitely confirmed for *Sterna dougallii*, but of international importance for *Sterna bergii*), the Iles Barren complex (MG036), and the south-western coastal wetlands (MG074; especially Nosy Manitse), which are subject to very high levels of commercial egg-harvesting. Surveys to evaluate the level of egg off-take and survival of young, and the possibility of agreements with local people to regulate egg-harvesting, are very high priorities. Several islets

around Madagascar have not yet been surveyed ornithologically. It is quite likely that some of them (especially on the south-east coast) hold significant breeding populations of seabirds.

The group of wetland IBAs located in the Antsalova region—the Manambolomaty wetland complex and Tsimembo Classified Forest (IBA MG039), the Bemamba wetland complex (MG038), and the wetlands of the Tsiribihina delta and upper Tsiribihina river (MG059)—is by far the most important in Madagascar for congregatory species of heron (Ardeidae) and ibis/spoonbill (Threskiornithidae). These sites are already integrated into the intervention areas of several conservation programmes such as the Bemaraha Project and the projects of the Durrell Wildlife Conservation Trust and The Peregrine Fund, but a programme to identify and protect the breeding colonies of these species, which are very threatened nationally, is essential.

Concerning the principal threats and pressures to IBAs, the sites located within the spiny forest EBA show, on average, the lowest level of threat among Malagasy EBAs, the most important threats being bush-fires, collection of firewood, roaming cattle and slash-and-burn cultivation. Of these threats, the first and last are the only ones which actually result in the complete removal of forest, which, on the poor soils of the south, is unlikely to grow again. In limited areas, browsing by goats has reduced forest regeneration and may be a severe problem in the future.

The eastern wet forests are most threatened by slash-and-burn cultivation, which is almost omnipresent. This activity permanently removes all forest-cover from the soil, which is then rapidly removed by rain. Many forests also experience heavy hunting and are home to roaming cattle, which are likely to delay or prevent forest regeneration in clearings through their trampling and selective browsing. It is almost certain that hunting has significant impacts on some of the larger species of forest-bird, such as *Lophotibis cristata* and ground-rollers *Brachypteracias*. The effects on bird populations of the roaming cattle (mostly wild) have not been studied.

Fires, particularly those set in the late dry season, threaten the western dry forests most heavily. Different areas of dry forest appear to have differing susceptibility to fire, those in the central-west and south being apparently less easily damaged. The forest around Ankarafantsika (IBA MG027) seems particularly vulnerable to fire. In the south and central-west, the most important threat is slash-and-burn cultivation, especially for maize. As in the east, this results in the permanent removal of the forest and almost all of its biodiversity.

The western wetlands are affected by many different pressures, notably drainage for agriculture, aquaculture (especially in the saltmarshes behind mangroves, often a very important habitat for birds) and hunting. Many species, particularly the larger colonial-nesting species, are in immediate danger of extinction from hunting.

The eastern wetlands are more vulnerable than those of the west to drainage and fire, particularly as many sites are under heavy demand for conversion to rice cultivation, and are burned every year to provide pasture for cattle and for hunting purposes. Intensification of rice cultivation, with canalization and drainage, is a particularly important threat in the large industrial rice-growing areas around Lake Alaotra (IBA MG046) and Marovoay (MG024). According to the national IBA inventory (ZICOMA 1999), this EBA is the most threatened of the five EBAs in Madagascar. However, this assessment is at least partly due to the fact that many sites within the EBA remain unknown and probably less disturbed.

COMMENTS ON THE INVENTORY

- Information on ‘Other threatened/endemic wildlife’ at each site generally covers lemurs, carnivores and sea-turtles. Data on the many other very important groups, such as plants or reptiles, is available, but was not incorporated into this inventory, due to the very large amount of extra work that this would have entailed.

ACKNOWLEDGEMENTS

The following people were responsible for the ZICOMA Project: *Coordination Committee*: National Coordinator: M. Rakotonomenjanahary Marijoelina Odon; Technical Advisers: Dr Frank Hawkins, Dr Peter Robertson, Mr Ron

Demey. *Technical Coordination*: ANGAP: Dr Faramalala Miadana Harisoa (Chef du Département de l’Information et de la Valorisation de la Biodiversité), Mlle Andrianarivo Chantal; Ministère des Eaux et Forêts: Mme Andriantsilavo Fleurette (Chef de Service de la Conservation de la Biodiversité), Mlle Andriantsalama Voahirana (Chef de Division Flore et Faune), Mme Rabeony Orly Manese (Collaborateur Technique). *Editorial Committee*: Mme Andrianarivo Chantal, Mme Andriantsilavo Fleurette, Mlle Andriantsalama Voahirana, Dr Faramalala Miadana Harisoa, Dr Lincoln Fishpool, Dr Frank Hawkins, Mme Rabeony Orly Manese, M. Rahagalala Pierre, M. Rakotonomenjanahary Odon, Mme Raminoarisoa Voninavoko, Mlle Razakanaivo Vero, Mrs Brigitte Carr-Dirick, Mr Ron Demey, M. Rabenandrasana Marc Nestor. *Collection and analysis of data*: Head, Analysis Team: Mme Raminoarisoa Voninavoko Maminandrasana; Head, Field Team: M. Rabenandrasana Marc Nestor; Administrator: M. Ramarason Teddy Lala; Assistant Editor: Mlle Razakanaivo Vero Lanto; Deputy Head, Field Team: M. Andriamasimanana Rado Hanitriniaina; Administrative Assistant: Mlle Rabeony Zarine Manese. *Members of the Field Team*: M. Randrianarisoa Mihajamanana, M. Sama Zefania, M. Sam The Seing, Mlle Virginie Marie Clémentine, M. Ranaritsito Isidore, M. Ramanitra Narisoa Andriamboavonjy. *Support Crew*: M. Rakotoarivelo Mamisoa, M. Andrianasoavina Norbert, the late M. Rakotoarimalala Mamy, M. Ravololoniaina Jeanne Marie, M. Randrianarison Jean Victor, M. Razafindrainibe Bruno.

The ZICOMA Project is very grateful to the following people and institutions for their help, without which the project would not have been possible: *Ministère des Eaux et Forêts*: M. Razafimandimby Hilarion (Directeur-Général), M. Andriamanandra Andry Nomenjanahary (Directeur de la Gestion Durable des Ressources Forestières). *ANGAP*: M. Randriamanandianina Baptiste Noel (Directeur-Général), M. Rasolofo Andriamahaly (Directeur-Général Adjoint de Réseau), M. Razafimanantsoa Georges (Directeur-Général Adjoint Administration et Finances), Mme Rasoarinoro Voahangy (Département SIG), M. Rahagalala Pierre (Assistant Scientifique). *Office National de l’Environnement*: M. Andriatsarafara Solofo, Mme Ramiarison Claudine. *Ecole Supérieure des Sciences Agronomes, Université d’Antananarivo, Département des Eaux et Forêts*: Dr Razakanirina Daniel (Président de l’ESSA), Dr Rajoelison Gabrielle (Chef du Département). *Département de Biologie Animale, Université d’Antananarivo*: Prof. Rakotofiringa Sylvère, Dr Rakotondravony Daniel. *WWF-Madagascar*: M. Jean-Paul Paddock, M. Raselimanana Achille, Mr Steven M. Goodman, Mr Mark Fenn, M. Koto Bernard, M. Randriakotonirina Samoela. *Durrell Wildlife Preservation Trust*: Dr Joanna Durbin, Mr Richard Lewis, M. Razafindrajao Felix. *Peregrine Fund*: M. Andrianarimisa Aristide (Directeur Nationale), M. Rabarisoa Rivo (Coordinateur Nationale des Denombrements des Oiseaux d’Eau), Mme Razandrianakanirina Daurette, Mr Russell Thorstrom, Mr Rick Watson. *Projet Bemaraha*: M. Rasoloarison Vonjisoa (Directeur National), M. François Busson (ex-Conseiller Technique). *Projet Mananara*: Mme Raondry Noeline (Coordinateur Nationale du Projet UNESCO-MAB à Madagascar). *PACT Madagascar*: M. Jean-Michel Dufils. *Conservation International*: M. Rajaobelina Léon (Directeur Nationale), Mr Lee Hannah, Mme Randriarimalala Rakotobe Zo Lalaina (Coordinateur Suivi-Evaluation), Dr Jutta Schmid. *Projet CAF*: M. Rakotonarivo Georges (Directeur National), M. Andrianorovelo Pierre Elliot (ex-Coordinateur Nationale), M. Rakotondrabe Bernard (Coordinateur Nationale). *Wildlife Conservation Society*: Mme Martina Hatchwell, Mr Matthew Hatchwell. *Libanona Ecology Centre/Projet Terpsiphone*: Dr Raoul Mulder, M. Emahalala Rayonne Ellis, M. Ramiarison Robert. *Asity (Ligue Malgache pour la Protection des Oiseaux)*: M. Ramanampamonjy Julien (Président), M. Randriamanindry Jean-Jacques. *Fanamby*: M. Rajaobelina Serge. *Parc Botanique et Zoologique de Tsimbazaza*: M. Randrianjafy Albert (Directeur), M. Ramanampamonjy Julien (Chef Section Oiseaux du Département Faune). *Royal Holloway Institute for Environmental Research*: Dr Roger Safford.

GLOSSARY

ANGAP National Association for the Management of Protected Areas (Association Nationale pour la Gestion des Aires Protégées).

cuesta asymmetric land-form consisting of a steep scarp slope, and a more gentle dip slope.

MEF Ministry of Water and Forests (Ministère des Eaux et Forêts).

NEAP National Environmental Action Plan.

nosy island.

tsingy heavily eroded limestone outcrop.

ZICOMA Zones d’Importance pour la Conservation des Oiseaux à Madagascar.

SITE ACCOUNTS

Cape Anorontany archipelago

Admin region Antsiranana

Coordinates 12°12'S 48°51'E

Area 458 ha Altitude 0–130 m

MG001

A1, A3 (A14), A4i
Unprotected

Site description

The site consists of 12 main islets, in three groups: (1) northern sandy islets: Nosy Foty (6 ha), Nosy Fasy (5 ha), Nosy Faty (1 ha) and Nosy Hao (10 ha); (2) northern rocky islets: Nosy Hara (115 ha), Nosy Vaha (1 ha), Nosy Lakandava (5 ha) and Nosy Anjombavola (30 ha); and (3) southern islets: Nosy Anambo (10 ha), Nosy Valiha (150 ha), Nosy Tanga (50 ha) and Nosy Manonoka (75 ha). The northern rocky islets are karstic and covered by a mixture of grassy vegetation and xerophilous shrubland including *Pachypodium*. The sandy islets are flat, covered by grass, *Ipomoea* mats and small *Casuarina* trees. The southern islets are more or less rocky, except Nosy Anambo, which is flat and sandy. The rocky islets are often covered by trees and palms such as *Bismarckia*. The islets are surrounded by coral reefs. Four other rocky islets north of Manonoka also support some breeding bird species.

Birds

See Box and Table 3 for key species. The site is home to two pairs of *Haliaeetus vociferoides*: one pair on Nosy Tanga, next to Cape St Sébastien, and one pair on Nosy Hara in the centre of the archipelago. Significant numbers of terns, including *Sterna caspia*, *S. dougallii*, *S. fuscata*, *S. bengalensis*, *Anous tenuirostris* and *A. stolidus*, have been observed on Nosy Fasy, Nosy Foty, Nosy Faty and Nosy Valiha, not all of them breeding. In July 1997, on Nosy Fasy, about 600 pairs of *S. bergii* (with 50 young) and 2,000 pairs of *S. fuscata* were recorded, while on Nosy Foty there were 1,500 pairs of *S. bergii* (60% breeding, with c.300 young), 30 pairs of *S. fuscata* and 50 pairs of *S. caspia* (with young), and on Nosy Faty there was a flock of *S. dougallii*.

Key species

A1 *Haliaeetus vociferoides*

A3 (A14) West Malagasy biome: One of the 24 species of this biome has been recorded at this site; see Table 3.

A4i		Breeding (pairs)	Non-breeding
	<i>Sterna bengalensis</i>	350	—
	<i>Sterna bergii</i>	3,200	—
	<i>Sterna dougallii</i>	500	—

Other threatened/endemic wildlife

Marine turtles are present.

Conservation issues

Massive collection of the eggs of breeding seabirds, in particular terns, is a severe threat. Only Nosy Tanga and the islets around Nosy Manonoka are naturally protected by the presence of rocks and cliffs, which make access by boats and pirogues difficult. Non-native rodents *Rattus rattus* and *Mus musculus* are present on some of the islets.

Further reading

Commission Nationale Malgache pour l'UNESCO (1998), Langrand (1987), Rabarisoa (1994), Rabarisoa *et al.* (1995), Watson *et al.* (1993).

East coast of Antsiranana

Admin region Antsiranana

Coordinates 12°27'S 49°33'E

Area 13,720 ha Altitude 0–10 m

MG002

A1, A2 (096), A3 (A14)
Unprotected

Site description

The site is located 60 km south-east of Antsiranana. It is composed of two areas: the Ambolobozokely wetlands and the Manampaho archipelago. The lakes and mangroves of Ambolobozokely wetlands are located on the coast between Antsiranana and Iharana (Vohimar), about 45 km from Antsiranana. The villages of Ambolobozokely and Ambolobozobe are located respectively north and south of the site. The lakes include stretches of water partially covered by non-native

Mimosa pudica and water-hyacinth *Eichhornia*. Most of these lakes are temporary. The levels of the others, including Lakes Ambondromifehy and Marofotsy, vary seasonally. The mangroves are dense and separated by stretches of seawater. They are little disturbed and include trees 3–5 m high on average. The waters immediately offshore are 0.7–1.5 m deep but may be 2.5 m deep at high tide. The islands of Tendro and Lowry are located in the far north and far south of this area. Manampaho archipelago includes the islands located between Irodo Bay and Andravina Bay, i.e. Manampaho, Korika, Ankao, Ratsy, Satrana, Vahala and Ambolonosy. Manampaho is surrounded by sand beaches and is covered by savanna, with scrub (1.5–2 m high), palms (e.g. *Cocos nucifera*) and mats of *Ipomoea*. Korika and Ambalanosy are mountainous islets, covered by savanna, with trees/bushes (5–8 m high). Satrana island is covered by coconut *Cocos* and *Bismarckia* palms. It is inhabited by fishermen with the result that there are no aquatic birds. Akomba, Manambiby and Ankao are the largest islands: they are inhabited and covered by savanna. Vahala is mountainous and uninhabited.

Birds

See Box and Tables 2 and 3 for key species. Twenty-nine species are known from the site, of which three are endemic to Madagascar. This is currently the only known site where *Anas bernieri* can be found on the east coast. *Sterna fuscata* breeds on Manampaho. Herons (Ardeidae) roost on Korika and Ambalanosy islets.

Key species

A1 *Anas bernieri*

A2 (096) West Malagasy wetlands EBA: Two of the six species of this EBA have been recorded at this site; see Table 2.

A3 (A14) West Malagasy biome: One of the 24 species of this biome has been recorded at this site; see Table 3.

Conservation issues

Fishing and hunting are threats, especially when birds are congregating. There is significant collection of *Sterna fuscata* eggs on Manampaho.

Further reading

Milon (1959).

Montagne d'Ambre National Park and Special Reserve

Admin region Antsiranana

Coordinates 12°32'S 49°10'E

Area 20,030 ha Altitude 850–1,475 m

MG003

A1, A2 (094), A3 (A15)
National Park,
Special Reserve

Site description

The site, a massif of volcanic origin, lies c.20 km south-west of Antsiranana. It comprises a 30-km-long string of basalt peaks, oriented north–south, with steep-sided valleys. Many rivers rise on the massif, the main ones being the Sahinana, Saharenana and Andranomandevy. There are also a number of lakes: Petit Lac, Grand Lac, Lac Maudit and Lac Texier. The north-eastern part of the site is covered by extensive low- and mid-altitude, dense, humid evergreen forests, dominated by trees of *Chrysophyllum*, *Canarium*, Lauraceae, Myrtaceae and Leguminosae, while the western part is covered in dense, dry deciduous forest. In between these two areas, there are transition forests.

Birds

See Box and Tables 2 and 3 for key species. Eighty-three species are known from the site, of which 41 are endemic to Madagascar. The level of local avian endemism is significant: *Phyllastrephus zosterops fulvescens* and *Monticola (sharpei) erythronotus* are restricted to the site (the latter being considered a separate species by some authorities). *Tyto soumagnei*, a species known from very few other sites, has also been recorded in the park. A pair of *Haliaeetus vociferoides* used to nest in the park, but no longer does so.

Key species

A1	<i>Tachybaptus pelzelni</i>	<i>Accipiter henstii</i>
	<i>Ardeola idae</i>	<i>Tyto soumagnei</i>
	<i>Lophotibis cristata</i>	<i>Atelornis pittoides</i>
	<i>Accipiter madagascariensis</i>	<i>Monticola (sharpei) erythronotus</i>
A2 (094)	East Malagasy wet forests EBA: Two of the 20 species of this EBA have been recorded at this site; see Table 2.	
A3 (A15)	East Malagasy biome: 12 of the 45 species of this biome have been recorded at this site; see Table 3.	

Other threatened/endemic wildlife

Lemurs: *Phaner furcifer electromontis* (VU), *Eulemur coronatus* (VU), *E. fulvus sanfordi* (VU), *Lepilemur septentrionalis* (VU), *Daubentonia madagascariensis* (EN). Carnivores: *Galidia elegans dambrensis* is locally endemic, *Cryptoprocta ferox* (VU), *Eupleres goudotii* (EN).

Conservation issues

In addition to its interest as a tourist site, the park is also important because it is the only hydrological reservoir for the entire far north of the country. Uncontrolled bush-fires are worsening soil erosion. Other threats include forest exploitation (in the southern part) and clearance (in the eastern part).

Further reading

Andreone (1994), Andriamampianina and Peyrieras (1972), Delacour (1932), Green *et al.* (1991), Jenkins (1987), Langrand and Lenormand (1985), Nicoll and Langrand (1989), Rand (1936), Raxworthy and Nussbaum (1994), Salomonsen (1934a).

Analamera Special Reserve
MG004

Admin region Antsiranana
 Coordinates 12°47'S 49°27'E A1, A2 (093), A3 (A14)
 Area 34,700 ha Altitude 10–608 m Special Reserve

Site description

This reserve is located 80 km south of Antsiranana. The site is limited by the steep-edged Analamera plateau in the north, by the Iloky river in the south and by small tributaries of the Anivorano river in the west. The south-eastern limit is located 1 km from the littoral. Analamera is a karstic plateau stretching from the Indian Ocean to the Ankarana plateau. Its steep cliffs rise to 400 m in the east and 359 m in the west, and overlook the Andrevo and Iloky rivers. The plateau is divided by many small streams flowing towards the Irodo river in the north. The main river is the Bobakindro, which flows across the northern area of the plateau. Analamera is an important hydrological reservoir, which feeds the flooded Irodo plain where rice-fields are located. In the valleys and well-watered areas, the vegetation is composed of western dense deciduous dry forest, with a canopy 15–20 m high.

Birds

See Box and Tables 2 and 3 for key species. Fifty-seven species are known from the site, of which 27 are endemic to Madagascar. The reserve is one of the two sites known for *Xenopirostris damii* and one of the six sites known for *Mesitornis variegata*. These two species both seem to be present in reasonable numbers, but *Haliaeetus vociferoides* is probably only a vagrant from nearby coasts.

Key species

A1	<i>Ardeola idae</i>	<i>Mesitornis variegata</i>
	<i>Lophotibis cristata</i>	<i>Xenopirostris damii</i>
	<i>Accipiter henstii</i>	
A2 (093)	West Malagasy dry forests EBA: Three of the six species of this EBA have been recorded at this site; see Table 2.	
A3 (A14)	West Malagasy biome: Five of the 24 species of this biome have been recorded at this site; see Table 3.	

Other threatened/endemic wildlife

Lemurs: *Eulemur coronatus* (VU), *E. fulvus sanfordi* (VU), *Lepilemur septentrionalis* (VU), *Propithecus diadema perrieri* (CR), *Daubentonia madagascariensis* (EN). Reptiles: *Boa manditra* (VU), *B. madagascariensis* (VU).

Conservation issues

The main threats include logging of hardwood trees for construction and use in traditional ceremonies, as well as annual burning of savanna areas within the forest.

Further reading

Hawkins *et al.* (1990), Meyers and Ratsiraron (1988), Nicoll and Langrand (1989).

Mitsio archipelago
MG005

Admin region Antsiranana
 Coordinates 12°54'S 48°36'E A1, A3 (A14)
 Area c.3,150 ha Altitude 0–206 m Unprotected

Site description

The site is located 50 km north-east of Nosy Be and 30 km off the western Malagasy coast. Nosy Mitsio, located in the centre of the archipelago, is the largest island, being c.12 km long and up to 3 km wide. One peak rises to 206 m in the northern area and another rises to 130 m in the centre. Surrounding islets include, in the north, Nosy Ankarea and Nosy Lava, and in the south, Nosy Antaly, Nosy Tsitampevina, Nosy Tsarabanjina, Nosy Toloho, and the 'Quatre Frères' islets. The Quatre Frères (Nosy Beangovo, Nosy Betalinjona, Nosy Antsoha and Nosy Betanihazo) are rocky contiguous domes, respectively 63 m, 76 m, 51 m and 88 m high. They are partly covered by savanna, especially on the summits. Nosy Lava is an elongated reef, 3.5 km long and 1.5 km wide, and covered by vegetation. It rises to 160 m. A beach, which floods at high tide, stretches along the northern part of this island. Nosy Toloho is covered by dense dry forest (up to 12–14 m high).

Birds

See Box and Table 3 for key species. Ten species are known from the site, of which one is endemic to Madagascar. The site is home to three breeding pairs of *Haliaeetus vociferoides* (on the Quatre Frères, Nosy Toloho and Nosy Lava). The Quatre Frères are also home to colonies of *Fregata ariel* and *F. minor*—the only site known in Madagascar where *Fregata* species breed—including c.50–100 pairs nesting on one of the islets. Some five pairs of *Phaethon lepturus* and 300–500 breeding individuals of *Sula leucogaster* have also been observed—the latter species has increased significantly since the 1970s. A pair of *Falco peregrinus* has been recorded on one of the islands.

Key species

A1	<i>Haliaeetus vociferoides</i>
A3 (A14)	West Malagasy biome: One of the 24 species of this biome has been recorded at this site; see Table 3.

Other threatened/endemic wildlife

Sirenian: *Dugong dugon* (VU).

Conservation issues

Neighbouring human populations fish in the marine area. The Quatre Frères are protected by their cliffs, which drop vertically into the sea and make access difficult. Most of the nests, especially of *Sula leucogaster*, are located on the cliffs.

Further reading

Langrand (1987), Polunin (1979), Rabarisoa *et al.* (1995), Watson *et al.* (1993).

Ankarana Special Reserve
MG006

Admin region Antsiranana
 Coordinates 12°55'S 49°06'E A1, A2 (093), A3 (A14)
 Area 18,225 ha Altitude 50–409 m Special Reserve

Site description

This reserve is located 70 km south of Antsiranana and 20 km north of Ambilobe. It is delimited by a cliff in the west, by the Mananjeba river in the south and, in the east, by the Route Nationale 6 between Antsiranana and Ambilobe. Ankarana is a massif of Jurassic limestone overlying a basaltic plain. The massif is highly eroded and karstic

(‘tsingy’), and is divided by deep, northward-running canyons, penetrated by caves. Several underground rivers, the most important of which are the Ankarana, Mananjeba and Besaboba, flow through these caves in an east–west direction (into Ambavanankarana Bay), creating a very complex drainage system. During the dry season, the massif is an important hydrological reservoir for neighbouring people and their domestic animals. There is a large variety of microhabitats. Flat limestone areas are covered by dense, dry deciduous forest, dominated by Leguminosae and Burseraceae. The basalt floor of the canyons, where little water can infiltrate, allows the presence of dense, humid evergreen forest, similar in structure to such forest in eastern Madagascar, and dominated by *Dalbergia*, *Canarium*, *Ficus*, *Zanthoxylum*, palms and Pandanaceae. Degraded areas contain bamboo *Olyra*. Xerophytes such as *Adenia*, *Aloe*, *Pachypodium* and *Noronhia* cover the tsingy. The surroundings of the massif are covered by typical western savanna with *Bismarckia* palms.

■ Birds

See Box and Tables 2 and 3 for key species. Ninety-four species are known from the site, of which 34 are endemic to Madagascar. The site is important for both forest birds and waterbirds. Forest birds occur in the ‘Foresters Canyon’ and the ‘Grand Canyon’ in the western part of the reserve, as well as in Analamay in the eastern part. Such birds are usually absent from the Tsingy May forest, an area of low vegetation on the most exposed rocks. The site is one of the six known for *Mesitornis variegata*, and holds (with nearby Andavakoera) the only populations of *Caprimulgus enarratus* known in the West Malagasy biome.

Key species

A1	<i>Ardea humbloti</i>	<i>Accipiter madagascariensis</i>
	<i>Ardeola idae</i>	<i>Mesitornis variegata</i>
	<i>Lophotibis cristata</i>	<i>Xenopirostris damii</i>
	<i>Haliaeetus vociferoides</i>	
A2 (093)	West Malagasy dry forests EBA: Three of the six species of this EBA have been recorded at this site; see Table 2.	
A3 (A14)	West Malagasy biome: Six of the 24 species of this biome have been recorded at this site; see Table 3.	

■ Other threatened/endemic wildlife

Lemurs: *Phaner furcifer ?electromontis* (VU), *Eulemur coronatus* (VU), *E. fulvus sanfordi* (VU), *Hapalemur griseus ?occidentalis* (VU), *Lepilemur septentrionalis* (VU), *Propithecus diadema perrieri* (CR), *Daubentonia madagascariensis* (EN). Carnivore: *Cryptoprocta ferox* (VU).

■ Conservation issues

Threats include illegal logging, mining, firewood collection, hunting of lemurs and birds, and water pollution.

■ Further reading

Decary and Kiener (1970), Fowler *et al.* (1989), Green *et al.* (1991), Hawkins *et al.* (1990), Jenkins (1987), Meyers and Ratsirarson (1988), Nicoll and Langrand (1989), Paulian (1961), Rand (1936), Remillet (1973), Simons *et al.* (1990), Walters *et al.* (1986), Wilson (1985), Wilson *et al.* (1987).

Andavakoera Classified Forest

Admin region Antsiranana

Coordinates 13°05'S 49°15'E

Area 13,833 ha Altitude 37–564 m

MG007

A1, A3 (A14)
Classified Forest

■ Site description

This site is located about 13 km north-east of Ambilobe. It is spread over three elongated mountains (aligned south-west to north-east)—Bobavato, Ambohibe and Andavakoera—between which are large, flat valleys. The south-eastern part of the site is bounded by a cliff. The topography is pronounced, with very steep slopes and areas of exposed bedrock. Three main rivers flow across the site: the Ambararata, which has its source on Andavakoera mountain and flows towards the south-east, and the Maharenina and Mananjeba, which flow down the valleys towards the south-west. The forest is mostly dry deciduous, in particular on the peaks and slopes. The remaining vegetation, notably the gallery forests, is composed of low-altitude, dense humid forest. The forest block on Andavakoera

mountain is intact. Dominant trees include *Canarium*, *Dalbergia*, *Hernandia*, *Eugenia*, *Capurodendron*, *Diospyros*, *Albizia* and *Commiphora*. Secondary woodland covers the slopes of Ambohibe and Bobavato mountains in the north and the west of the site. Savanna, with few or no trees/shrubs, occurs adjacent to the gallery forests.

■ Birds

See Box and Table 3 for key species. Sixty-two species are known from the site, of which 30 are endemic to Madagascar. Species characteristic of both dry forest (e.g. *Falco pascuorum*) and wet forest (e.g. *Caprimulgus enarratus*, *Phyllastrephus zosterops* and *Coua caerulea*) are present.

Key species

A1	<i>Lophotibis cristata</i>	<i>Philepitta schlegeli</i>
	<i>Accipiter henstii</i>	
A3 (A14)	West Malagasy biome: Two of the 24 species of this biome have been recorded at this site; see Table 3.	

■ Other threatened/endemic wildlife

Lemurs: *Eulemur coronatus* (VU), *E. fulvus sanfordi* (VU), *Lepilemur septentrionalis* (VU), *Propithecus diadema perrieri* (CR), *Phaner furcifer* (nt), *Daubentonia madagascariensis* (EN). Carnivore: *Cryptoprocta ferox* (VU).

■ Conservation issues

Slash-and-burn cultivation, uncontrolled bush-fires and illegal exploitation of wood threaten the integrity of the forest.

■ Further reading

Direction des Eaux et Forêts (1996), Projet COEFOR/CI SRF-DEF (1993), Ramandimbison (1995).

Lake Sahaka Hunting Reserve

Admin region Antsiranana

Coordinates 13°06'S 49°53'E

Area 3,000 ha

Altitude 0–40 m

MG008

A2 (096), A3 (A14), A4i
Hunting Reserve,
Unprotected

■ Site description

The site lies on the eastern littoral, and is flat with sandy soil. It includes the freshwater Lake Sahaka—part of which, Lake Gendarme (120 ha) is a Hunting Reserve—as well as the neighbouring wetlands Ampanasina-North, Ampanasina-Centre, Ampanasina-South, Ampasirabe, Doanihely and Doanibe. Lake Sahaka is fed by the Antsahampano river and many springs, and flows into the Manambato river. There is a large variety of habitats, including clearwater lakes, expanses of water-lilies (Nymphaeaceae), marshes with reedbeds of *Phragmites*, seasonal lakes, savanna with palms *Bismarckia* and baobabs (Bombacaceae), and a block of littoral forest. Part of the lake surface has been invaded by non-native water-hyacinth *Eichhornia*. The lake has good fish stocks and is a refuge for waterbirds.

■ Birds

See Box and Tables 2 and 3 for key species. Fifty-two species are known from the site, of which 14 are endemic to Madagascar. The location of the site between the East and West Malagasy biomes explains the presence of western species such as *Actophilornis albinucha*, *Falco pascuorum*, *Ploceus sakalava*, and of one species specific to eastern wetlands (*Anas melleri*). The African species *Ardea goliath*, which is very rare in Madagascar, has been observed at the site. Species of global conservation concern include *Ardeola idae*.

Key species

A2 (096)	West Malagasy wetlands EBA: One of the six species of this EBA has been recorded at this site; see Table 2.		
A3 (A14)	West Malagasy biome: Two of the 24 species of this biome have been recorded at this site; see Table 3.		
A4i	<i>Casmerodius albus</i>	Breeding (pairs)	Non-breeding
		—	678

■ Other threatened/endemic wildlife

Lemurs: *Eulemur coronatus* (VU), *E. fulvus sanfordi* (VU). Reptiles: *Boa madagascariensis* (VU), *B. manditra* (VU).

Conservation issues

The main threats to the site include fishing, rice cultivation on shallow marshes, and hunting. Repeated bush-fires have increased soil erosion, and thus sedimentation in the lakes, resulting in the seasonal drying-out of Lake Gendarme and of the Ampasirabe wetlands.

Further reading

Safford *et al.* (1998), Sana (1987).

Ambavanankarana wetlands

MG009

Admin region Antsiranana

Coordinates 13°07'S 48°46'E

A1, A2 (096), A3 (A14), A4i

Area 61,220 ha Altitude 5–10 m

Unprotected

Site description

This site consists of a strip of mangrove located along the western coast and stretching over 90 km between Antsatsaka (25 km north of Ambanja) in the south, and Bobasakoa (45 km north-west of Ambilobe) in the north. Ambaro Bay lies off its southern part. Ampasinantenina (Port Saint Louis) peninsula divides the site into two parts, where the city of Antsohimondrona is directly linked to Ambilobe by a tar road 30 km long. In addition to the mangrove, this site includes mudflats (1 km wide at low tide), lakes and saltmarshes. The main rivers in the area, the Bobasakoa, Andranomandevy, Mananjeba, Mahavavy, Itasy and Ambazoana, flow from north to south into the Mozambique Channel. Several of them (some nutrient-poor) rise from the underground waters of the Ankarana massif. The mangrove woodland is mainly composed of *Avicennia* and *Rhizophora* trees (5–10 m high).

Birds

See Box and Tables 2 and 3 for key species. Forty-eight species are known from the site, of which seven are endemic to Madagascar. The site supports the largest congregations of *Dromas ardeola* and *Sterna saundersi* known in Madagascar.

Key species

A1	<i>Ardea humbloti</i> <i>Anas bernieri</i>	<i>Haliaeetus vociferoides</i>
A2 (096)	West Malagasy wetlands EBA: Three of the six species of this EBA have been recorded at this site; see Table 2.	
A3 (A14)	West Malagasy biome: Four of the 24 species of this biome have been recorded at this site; see Table 3.	
A4i	Breeding (pairs)	Non-breeding
	<i>Dromas ardeola</i>	— 900
	<i>Sterna bengalensis</i>	— 350
	<i>Sterna saundersi</i>	— 236

Conservation issues

This mangrove woodland is threatened by intensive cutting in some areas, and breeding-bird colonies are affected by the collection of eggs and young birds.

Further reading

Durand *et al.* (1966).

Daraina Forest

MG010

Admin region Antsiranana

Coordinates 13°19'S 49°34'E

A1, A2 (093, 094), A3 (A14)

Area 30,263 ha Altitude 100–1,171 m

Unprotected

Site description

The site consists of the second parcel of the Binara Forest, which is part of the Daraina Forest. It is located on a mountainous massif with steep, rocky slopes. The headwaters of several rivers lie in the site. The forest is divided into two adjacent blocks. The western block, Andrangovato Forest, is composed of dense, dry, semi-deciduous forest (10–20 m high), while the other block, Andranofotitra Forest, is composed of dense, humid evergreen forest (up to c.25 m). The most characteristic tree species are those of the

Sapotaceae, Rubiaceae, Loganiaceae, Acanthaceae, Asclepiadaceae and Guttiferaceae. Most of them are food sources for lemurs. Areas of primary forest are separated by relatively old secondary forests and by savanna.

Birds

See Box and Tables 2 and 3 for key species. There is an unusual mixture of eastern and western species in the different types of forest; however, the areas of humid forest seem to be somewhat depauperate in comparison to other lowland forests.

Key species

A1	<i>Lophotibis cristata</i> <i>Accipiter madagascariensis</i> <i>Accipiter henstii</i> <i>Mesitornis variegata</i>	<i>Brachypteracias leptosomus</i> <i>Brachypteracias squamigera</i> <i>Monticola sharpei</i>
A2 (093)	West Malagasy dry forests EBA: Two of the six species of this EBA have been recorded at this site; see Table 2.	
A2 (094)	East Malagasy wet forests EBA: Four of the 20 species of this EBA have been recorded at this site; see Table 2.	
A3 (A14)	West Malagasy biome: Four of the 24 species of this biome have been recorded at this site; see Table 3.	

Other threatened/endemic wildlife

Lemurs: *Eulemur coronatus* (VU), *E. fulvus sanfordi* (VU), *Propithecus tattersalli* (CR), *Daubentonia madagascariensis* (EN).

Conservation issues

Clearance of gallery forest, hunting (of wild boar, lemurs and birds) and gold-mining are causing rapid degradation of the site. The proposal to list Daraina Forest as a national park results from a survey on the distribution and conservation of *Propithecus tattersalli*, which is one of the most threatened Malagasy primates. The proposed National Park should include the Binara Forest, the dry forests and the gallery forests located north of Daraina village. The proposed park would comprise three parcels covering c.10,000 ha, including the neighbouring grassland. The NGO Fanamby is currently providing support to community-based conservation initiatives.

Further reading

BIODEV Madagascar (1998), Meyers and Ratsirarson (1988), Projet CAF/APN (1998).

Nosy Be and satellite islands

MG011

Admin region Antsiranana

Coordinates 13°20'S 48°15'E

Area 28,108 ha

Altitude 0–515 m

A1, A3 (A14)

Strict Nature Reserve,

Unprotected

Site description

Located in the north-west of Madagascar, this site is composed of a group of islands and islets. Nosy Be is the largest island off the coast of Madagascar (c.25,200 ha). It is mountainous, rising to 430 m in the south-east. Its eastern coast is mainly occupied by agriculture, notably sugar-cane. Dense, humid evergreen forest remains more or less intact in the centre of the island and also in Lokobe Strict Nature Reserve in the south-east. Several small islands and islets surround Nosy Be. Nosy Komba (2,200 ha) lies c.3 km south-east of Nosy Be. It is pyramidal, with a peak 579 m high, and is covered by dense, humid evergreen forest. There are a few small fishing villages. Nosy Sakatia (500 ha), located west of Nosy Be, is also covered by dense, humid evergreen forest. It is mountainous (up to 137 m high). Nosy Tanikely (c.30 ha) is an islet with cliffs in the north and west, and sandy beaches in the south and east. It is a marine reserve, surrounded by beautiful coral reefs. Its central plateau is covered by dense, humid evergreen forest. Nosy Raty (c.30 ha) is a small basaltic islet, covered by savanna with some woody species. Nosy Fanihy (25 ha) is a raised reef (several tens of metres above sea-level) north of Nosy Be, covered in woodland (10–15 m) with lianas. The understorey is open and easy to access, despite the presence of spiny shrubs. At low tide, the beach in the south-east of the island is exposed. Thirty kilometres south-west of Nosy Be, near the Ampasindava peninsula, there is a group of small islets and rocks: Nosy Kivongy,

Nosy Antsoha and Nosy Ankazoberavina (each less than 50 ha in area).

■ Birds

See Box and Table 3 for key species. Four pairs of *Haliaeetus vociferoides* breed on the satellite islands of Nosy Be (Nosy Antsoha, Nosy Ankazoberavina, Nosy Vorona and Nosy Fanihy) and at least one pair breeds on Nosy Be. A few dozen pairs of *Sula leucogaster* breed on Nosy Kasinjo. Nosy Raty holds five breeding pairs of *Egretta dimorpha*.

Key species

A1 *Haliaeetus vociferoides*
 A3 (A14) West Malagasy biome: One of the 24 species of this biome has been recorded at this site; see Table 3.

■ Other threatened/endemic wildlife

Lemurs: *Eulemur macaco macaco* (VU), *Lepilemur dorsalis* (VU).

■ Conservation issues

Lokobe Strict Nature Reserve is located on Nosy Be. The most important areas of the site are protected by their difficulty of access. Only Nosy Be, Nosy Komba and Nosy Tanikely are inhabited permanently, but only one family resides on Nosy Tanikely. Nosy Vorona is a sacred islet protected by taboos. Nosy Fanihy and Nosy Sakatia are the only accessible islets. Nosy Be is the main touristic centre in Madagascar. Several hotels and tour-operators organize visits to the islets, especially Nosy Komba, Nosy Tanikely and Nosy Sakatia, for their coral reefs and sandy beaches. Nosy Komba is home to a population of the lemur *Eulemur macaco macaco* which has become accustomed to tourists. These visits do not directly threaten the breeding *Haliaeetus vociferoides* (although they do threaten the coral reefs), but the activities of the numerous boats may disturb the species.

■ Further reading

Battistini (1959), Langrand (1987), Rabarisoa (1994), Watson *et al.* (1993).

Ampasindava Bay wetlands

MG012

Admin region Antsiranana

Coordinates 13°52'S 48°04'E

A1, A2 (096), A3 (A14)

Area 163,100 ha Altitude 0–10 m

Unprotected

■ Site description

The site is composed of bays, rivers and estuaries located in the coastal zone of the Ampasindava peninsula. The relief of the peninsula is very much marked, with cuetas and outcrops of lias, sandstone and schist, dissected by many rivers (the main ones being the Bemanevika, Barimahamay and Anafiafy). The coastal vegetation consists of mangrove woodland, sometimes interrupted by littoral forest.

■ Birds

See Box and Tables 2 and 3 for key species. Among the 39 recorded species, 15 are endemic. A few *Threskiornis (aethiopicus) bernieri* occur, as well as some pairs of *Haliaeetus vociferoides*. According to local information, *Anas bernieri* breeds at the site.

Key species

A1 *Ardea humbloti* *Haliaeetus vociferoides*
 A2 (096) West Malagasy wetlands EBA: Two of the six species of this EBA have been recorded at this site; see Table 2.
 A3 (A14) West Malagasy biome: Three of the 24 species of this biome have been recorded at this site; see Table 3.

■ Other threatened/endemic wildlife

Lemurs: *Eulemur macaco macaco* (VU), *Daubentonia madagascariensis* (EN).

■ Conservation issues

The mangrove trees are used for firewood and construction wood.

■ Further reading

Battistini (1959), Langrand (1987), Rabarisoa (1994), Rabarisoa *et al.* (1995), Watson *et al.* (1993).

Manongarivo Special Reserve

MG013

Admin region Antsiranana

Coordinates 13°59'S 48°23'E

A2 (093, 094), A3 (A15)

Area 35,250 ha Altitude 57–1,876 m

Special Reserve

■ Site description

This site, a mountainous massif, is located about 60 km south of Ambanja. Steep slopes (25–55°) cover about half of its area. Valleys are narrow and littered with large boulders. The headwaters of the Manongarivo river, and of tributaries of the Sambirano, Djangoa and Ambahatra rivers, all lie within the reserve, which functions as a hydrological reservoir for the surrounding area. The vegetation is composed of low- and mid-altitude dense humid forest. Low-altitude dry-transitional forest covers 18% of the reserve, and is dominated by trees of *Canarium*, *Symphonia* (and other species of Guttiferae), *Terminalia*, *Ravensara* and species of Sapotaceae, with smaller trees such as *Phyllarthron* in the subcanopy. The understorey is dominated by large lianas (e.g. *Landolphia* spp.) and palms (e.g. *Dypsis*). Mid- and higher-altitude forest covers 28% of the site, extending to the summit of the mountain at 1,876 m; epiphytes are common (*Rhipsalis*, *Platyserium*, *Drymaria*, *Asplenium*, *Bulbophyllum*, *Angraecum*) and there are also rare trees such as *Calliandra kony* and *Takhtajania perrieri*.

■ Birds

See Box and Tables 2 and 3 for key species. Sixty species are known from the site, of which 30 are endemic to Madagascar. However, knowledge of the bird fauna is incomplete and recent inventories are likely to increase these figures. *Philepitta schlegeli* and *Falco pascuorum*, species characteristic of the West Malagasy biome, are present at low altitudes at the site. Species of global conservation concern include *Lophotibis cristata*.

Key species

A2 (093) West Malagasy dry forests EBA: One of the six species of this EBA has been recorded at this site; see Table 2.
 A2 (094) East Malagasy wet forests EBA: One of the 20 species of this EBA has been recorded at this site; see Table 2.
 A3 (A15) East Malagasy biome: Six of the 45 species of this biome have been recorded at this site; see Table 3.

■ Other threatened/endemic wildlife

Lemurs: *Phaner furcifer parienti* (VU), *Eulemur macaco* (VU), *Haplemur griseus occidentalis* (VU), *Lepilemur dorsalis* (VU), *Daubentonia madagascariensis* (EN). Carnivore: *Cryptoprocta ferox* (VU). Reptiles: *Boa manditra* (VU), *B. madagascariensis* (VU). Butterfly: *Papilio groesmithi* (nt).

■ Conservation issues

The main threat to the site is slash-and-burn cultivation. The forest is also illegally exploited for firewood and construction wood, and this is altering the hydrology of the region. At least 75 plant species in the reserve are used medicinally by local people. Lemurs, carnivores and tenrecs are hunted, and cattle-grazing is increasing within the reserve.

■ Further reading

ANGAP/ORGASYS (1998), Milon (1951), Nicoll and Langrand (1989), Rand (1936), Thompson *et al.* (1988).

Tsaratana Strict Nature Reserve and adjacent areas

MG014

Admin region Antsiranana

A1, A2 (094, 095), A3 (A15)

Coordinates 14°02'S 48°52'E

Strict Nature Reserve,

Area 48,622 ha Altitude 227–2,876 m

Unprotected

■ Site description

Tsaratana, located south of Ambanja, is the highest mountain range in Madagascar, with the peak of Maromokotro rising to 2,876 m. It is of volcanic origin, being composed of granite and migmatite. The headwaters of the Ramena, Sambirano and Mahavavy rivers lie within the reserve. Mid-altitude, dense, humid evergreen forest, characterized by an abundance of trees 10–12 m high, lianas and palms, covers the area up to 2,000 m. Dense bamboo forest, forming a belt, characterizes the area located between 2,000 and 2,200 m. Sclerophyllous montane

forest is found between 2,200 and 2,600 m and grassy savanna occurs above 2,600 m (of human origin, having replaced the original montane bushland following repeated burning and livestock-grazing).

■ Birds

See Box and Tables 2 and 3 for key species. Ninety-four species are known from the site, of which 56 are endemic. *Tyto soumagnei* was found at an altitude of 2,000 m, the highest known for this species. This is also the northern limit known for *Eutriorchis astur*. Many species occur at higher altitudes here than elsewhere in their ranges. The subspecies *Saxicola torquata tsaratananensis* is limited to this site.

Key species

A1	<i>Lophotibis cristata</i>	<i>Phyllastrephus cinereiceps</i>
	<i>Eutriorchis astur</i>	<i>Euryceros prevostii</i>
	<i>Accipiter henstii</i>	<i>Monticola sharpei</i>
	<i>Tyto soumagnei</i>	<i>Hartertula flavoviridis</i>
	<i>Brachypteracias leptosomus</i>	<i>Crossleyia xanthophrys</i>
	<i>Atelornis pittoides</i>	<i>Dromaeocercus brunneus</i>
	<i>Atelornis crossleyi</i>	<i>Randia pseudozosterops</i>
	<i>Neodrepanis hypoxantha</i>	<i>Pseudobias wardi</i>
A2 (094)	East Malagasy wet forests EBA: 12 of the 20 species of this EBA have been recorded at this site; see Table 2.	
A2 (095)	East Malagasy wetlands EBA: Two of the seven species of this EBA have been recorded at this site; see Table 2.	
A3 (A15)	East Malagasy biome: 31 of the 45 species of this biome have been recorded at this site; see Table 3.	

■ Conservation issues

The forest in the massif is nearly intact, both within the reserve and in neighbouring areas. Threats to the site include cattle-grazing, cutting of certain tree species for their bark (used for flavouring alcoholic beverages), and cannabis cultivation in the Ramena valley.

■ Further reading

Andriamampianina and Peyrieras (1972), Albignac (1970), ANGAP/ORGASYS (1998), Milon (1951), Nicoll and Langrand (1989).

Anjanaharibe-South Special Reserve

MG015

Admin region Antsiranana

Coordinates 14°33'S 49°24'E

A1, A2 (094), A3 (A15)

Area 32,090 ha Altitude 500–2,064 m

Special Reserve

■ Site description

This site is a highly indented mountainous massif, composed of migmatite, quartzite and granite, and with steep slopes. Its north-eastern part, which is steeper, is part of the crystalline edge of the Andapa basin. Annual rainfall can exceed 3,000 mm at the higher altitudes. The reserve is the most important watershed for the rivers flowing to the north and the south of the Andapa basin to join the rivers flowing to the east. The main rivers are the Andramonta in the north, the Marolakana in the centre, and the Ankaibe and Manandriana in the south-east. Three types of vegetation can be found: low-altitude, dense, humid evergreen forest (up to 900 m); mid-altitude, dense, humid evergreen forest (900–1,100 m); and dense montane forest (above 1,100 m). Notable forest trees include *Dalbergia*, *Diospyros*, *Weinmannia* and *Eugenia*.

■ Birds

See Box and Tables 2 and 3 for key species. The site holds most of the species that are characteristic of the eastern forest.

Key species

A1	<i>Lophotibis cristata</i>	<i>Phyllastrephus cinereiceps</i>
	<i>Eutriorchis astur</i>	<i>Oriolia bernieri</i>
	<i>Accipiter madagascariensis</i>	<i>Euryceros prevostii</i>
	<i>Accipiter henstii</i>	<i>Monticola sharpei</i>
	<i>Mesitornis unicolor</i>	<i>Hartertula flavoviridis</i>
	<i>Brachypteracias leptosomus</i>	<i>Crossleyia xanthophrys</i>
	<i>Brachypteracias squamigera</i>	<i>Dromaeocercus brunneus</i>
	<i>Atelornis pittoides</i>	<i>Randia pseudozosterops</i>
	<i>Atelornis crossleyi</i>	<i>Newtonia fanovanae</i>
	<i>Neodrepanis hypoxantha</i>	<i>Pseudobias wardi</i>

A2 (094) East Malagasy wet forests EBA: 17 of the 20 species of this EBA have been recorded at this site; see Table 2.

A3 (A15) East Malagasy biome: 35 of the 45 species of this biome have been recorded at this site; see Table 3.

■ Other threatened/endemic wildlife

Lemurs: *Allocebus trichotis* (CR), *Eulemur rubriventer* (VU), *Indri indri* (EN), *Propithecus diadema candidus* (EN), *Daubentonia madagascariensis* (EN). Carnivores: *Cryptoprocta ferox* (VU), *Fossa fossana* (VU).

■ Conservation issues

The reserve is a hydrological reservoir for the Andapa basin, one of the main rice-growing areas in Madagascar. The reserve is also important for ecotourism. Threats to the site include illegal exploitation of wood, hunting, collection of the bark of some tree species to flavour alcoholic beverages, and gem-mining.

■ Further reading

Goodman (1998), Halleux and Goodman (1994), Hawkins (1995a), Hawkins *et al.* (1998), Nicoll and Langrand (1989), Rand (1936), Thiollay (1998).

Marojejy National Park

MG016

Admin region Antsiranana

Coordinates 14°26'S 49°42'E

A1, A2 (094), A3 (A15)

Area 60,150 ha Altitude 75–2,133 m

National Park

■ Site description

Marojejy National Park comprises the forested Marojejy massif and its neighbouring foothills. The massif is mountainous, with steep, granitic peaks, quartzite crests and narrow valleys. There are significant variations in microclimate, from sub-humid to humid, and from cold to temperate. In some areas, annual rainfall is over 3,000 mm. October is the driest month and January the wettest. Winter temperatures may fall to around 2°C in higher areas. The Androranga river flows along the northern boundary of the park and the Lokoho river in the south and east. Marojejy is the only one of the five large mountainous massifs in Madagascar whose high-altitude vegetation is still largely intact. Most of the site is covered in dense, humid evergreen forest. However, because of the great range of altitudes that the massif spans, it supports four distinct types of vegetation: (1) Low-altitude, dense, humid evergreen forest in the valleys. This forest is largely degraded. The emergent tree *Canarium* is abundant. Acanthaceae, Urticaceae and Gramineae are well represented in the ground layer, and tree-ferns are common. Secondary vegetation, partially dominated by giant bamboo *Ochlandra* and wild ginger *Aframomum*, occurs in the lowest areas, near the park boundary. (2) Mid-altitude, dense, humid evergreen forest, with a grassy ground layer dominated by herbs such as *Begonia*, *Exacum*, *Gravesia*, *Impatiens* and *Phaius*. (3) Dense sclerophyllous montane forest. (4) Montane bushland dominated by tree-heath *Erica* occurs at the highest altitudes, as do patches of grassland.

■ Birds

See Box and Tables 2 and 3 for key species. Ninety-six species are known from the site, of which 63 are endemic. The bird fauna of the park is very rich: nearly all of the species that are restricted to eastern forest have been recorded. *Eutriorchis astur* was discovered in the park in 1988, after c.50 years without any records throughout its range.

Key species

A1	<i>Lophotibis cristata</i>	<i>Phyllastrephus cinereiceps</i>
	<i>Eutriorchis astur</i>	<i>Oriolia bernieri</i>
	<i>Accipiter henstii</i>	<i>Euryceros prevostii</i>
	<i>Mesitornis unicolor</i>	<i>Monticola sharpei</i>
	<i>Brachypteracias leptosomus</i>	<i>Hartertula flavoviridis</i>
	<i>Brachypteracias squamigera</i>	<i>Crossleyia xanthophrys</i>
	<i>Atelornis pittoides</i>	<i>Dromaeocercus brunneus</i>
	<i>Atelornis crossleyi</i>	<i>Randia pseudozosterops</i>
	<i>Neodrepanis hypoxantha</i>	<i>Newtonia fanovanae</i>
	<i>Phyllastrephus tenebrosus</i>	<i>Pseudobias wardi</i>
A2 (094)	East Malagasy wet forests EBA: 18 of the 20 species of this EBA have been recorded at this site; see Table 2.	

A3 (A15) East Malagasy biome: 37 of the 45 species of this biome have been recorded at this site; see Table 3.

Other threatened/endemic wildlife

The site is a major centre of endemism in the Eastern Malagasy region. Bat: *Myzopoda aurita* (VU). Lemurs: *Eulemur rubriventer* (VU), *Propithecus diadema candidus* (CR), *Daubentonia madagascariensis* (EN). Carnivores: *Fossa fossana* (VU), *Cryptoprocta ferox* (VU), *Galidictis fasciata* (VU). Butterfly: *Papilio mangoura* (VU).

Conservation issues

Threats to the site include slash-and-burn cultivation, hunting, wood exploitation, and collection of other forest resources. These activities are more intense in the south-eastern area of the park than in the north.

Further reading

Andriamampianina and Peyrieras (1972), Benson *et al.* (1977), Colebrook-Robjent (1973), Duckworth *et al.* (1995), Evans *et al.* (1992), Forbes-Watson (1966), Guillaumet *et al.* (1973), Humbert (1995), Jenkins (1987), Nicoll and Langrand (1989), Safford and Duckworth (1990), Salomonsen (1934a), Sheldon and Duckworth (1990), Thiollay and Meyburg (1981).

Masoala National Park

MG017

Admin region Antsiranana

Coordinates 15°32'S 50°03'E

A1, A2 (094), A3 (A15)

Area 230,000 ha Altitude 0–1,224 m

National Park

Site description

This site is located on the Masoala peninsula. It consists of a terrestrial area, covering 67% of the forested massif of the peninsula in the west, and a marine area that includes three reserves—Tampolo, Tanjona and Cape Masoala—and a marine sanctuary in Antongil Bay. The western slope of the peninsula, starting c.10 km in from the coast, is very steep while the eastern slope, c.50 km wide, inclines gently. About 98% of the site's land surface is covered by more or less intact, low- to mid-altitude, humid evergreen forest.

Birds

See Box and Tables 2 and 3 for key species. One hundred and eleven species are known from the site, of which 60 are endemic to Madagascar. The park is the first site where research could be carried out on *Eutriorchis astur* and it is the best known area for the protection of this threatened species.

Key species

A1	<i>Ardeola idae</i>	<i>Brachypteracias squamigera</i>
	<i>Lophotibis cristata</i>	<i>Atelornis pittoides</i>
	<i>Eutriorchis astur</i>	<i>Phyllastrephus cinereiceps</i>
	<i>Accipiter madagascariensis</i>	<i>Oriolia bernieri</i>
	<i>Accipiter henstii</i>	<i>Euryceros prevostii</i>
	<i>Mesitornis unicolor</i>	<i>Monticola sharpei</i>
	<i>Tyto soumagnei</i>	<i>Randia pseudozosterops</i>
	<i>Brachypteracias leptosomus</i>	<i>Pseudobias wardi</i>

A2 (094) East Malagasy wet forests EBA: 11 of the 20 species of this EBA have been recorded at this site; see Table 2.

A3 (A15) East Malagasy biome: 29 of the 45 species of this biome have been recorded at this site; see Table 3.

Other threatened/endemic wildlife

Plants: there are palms which are endemic to the Sahavavy, Hiaraka and Antalavia region, such as *Marojejya darainii*, *Dyopsis pachyramea* and *Lemurophoenix halleuxi*, as well as a carnivorous pitcher-plant endemic to the peninsula, *Nepenthes masoalensis*. Lemurs: *Varecia variegata rubra* (CR), *Daubentonia madagascariensis* (EN), *Phaner furcifer furcifer* (nt), *Phaner furcifer* (VU), *Eupleres goudotii* (EN), *Cryptoprocta ferox* (VU), *Salanoia concolor* (VU).

Conservation issues

Threats to the site include slash-and-burn cultivation, exploitation for wood, and hunting of lemurs, wild boar and some bird species, as well as collection of other wild foodstuffs and medicinal plants.

Further reading

Andreone, (1994), Andriamampianina and Peyrieras (1972), Aurivillius and Aurivillius (1994), Berkelman (1997), Eguchi *et al.* (1993), Jenkins (1987), Nicoll and Langrand (1989), Razafindrasoa (1996), Safford and Duckworth (1990), Thiollay and Meyburg (1981), Thorstrom *et al.* (1994), Thorstrom and Watson (1997), Thorstrom *et al.* (1994), Wildlife Conservation Society (1995).

Sahamalaza Bay wetlands

MG018

Admin region Mahajanga

Coordinates 14°13'S 47°59'E

A1, A3 (A14), A4i

Area 59,080 ha Altitude 0–355 m

Unprotected

Site description

The site comprises the Sahamalaza peninsula, the 30-km-long bay itself, the mangrove to the east of the peninsula (8,400 ha) and the coral reefs to the west (more than 10,000 ha). The peninsula has steep slopes, rising to 170 m in the southern part. Its west coast is stony and rocky, with mangroves. The principal rivers flowing into the bay are the Andranomalaza, which passes the town of Maromandia, and the Manamboro and Samonta, which lie to the south. On the slopes, the vestiges of a dense, dry deciduous forest form two blocks, situated in the south (Analavory Forest) and west (north of Ambinda village) of the peninsula. The dominant tree species include *Dalbergia*, *Albizia* and *Tamarindus*. The north-eastern part has been cleared of forest, but seems to be regenerating. In the mangroves, all eight mangrove tree species found in Madagascar are present, and can reach more than 8 m in height.

Birds

See Box and Table 3 for key species. The site is important for several pairs of *Haliaeetus vociferoides* and large flocks of *Sterna bengalensis*.

Key species

A1	<i>Ardea humbloti</i>	<i>Lophotibis cristata</i>
	<i>Ardeola idae</i>	<i>Haliaeetus vociferoides</i>
A3 (A14)	West Malagasy biome: Three of the 24 species of this biome have been recorded at this site; see Table 3.	
A4i	<i>Sterna bengalensis</i>	Breeding (pairs) Non-breeding
		— 575

Other threatened/endemic wildlife

Lemurs: *Phaner furcifer* (nt), *Eulemur macaco flavifrons* (CR), *Haplemur griseus occidentalis* (VU), *Lepilemur dorsalis* (VU), *Avahi occidentalis* (VU), *Daubentonia madagascariensis* (EN). Carnivore: *Cryptoprocta ferox* (VU).

Conservation issues

A consortium of universities and zoos, acting on behalf of MEF, is studying the possible designation of Sahamalaza Bay as a national park. The site is experiencing over-exploitation of its natural resources, such as mangrove products and sea-cucumbers of the coral reefs. Slash-and-burn cultivation and burning of grassland also constitute threats to the site.

Further reading

Andriamanandraotra (1996), Andrianantenaina (1996), Commission Nationale Malgache pour l'UNESCO (1998), Iltis (1996), Rakotondravony (1996), Raselimanana (1995), Ravokatra (1996).

Ankaizina wetlands

MG019

Admin region Mahajanga

Coordinates 14°30'S 48°43'E

A1, A2 (095), A3 (A15)

Area 11,490 ha Altitude 1,000 m

Unprotected

Site description

The Ankaizina wetlands lie 5–10 km north of Bealanana and consists of Lakes Anakarefo, Beandrazazina and Matsaboramadio, Nanilezana marsh, and two other unnamed lakes. The area lies in an alluvial basin, ringed by hills of gneiss, granite, basalt and trachyte. The lakes are shallow and often turbid. The wetland complex is fed from the west

by the Maevarano river and from the east by the Sofia and the Manampatrana. The water surface is partly covered by non-native water-hyacinth *Eichhornia*, and bordered in places by stands of sedge *Cyperus*, *Raphia* palms and grasses.

■ Birds

See Box and Tables 2 and 3 for key species. *Ardea humbloti* is a species normally associated with the West Malagasy biome.

Key species

A1	<i>Tachybaptus pelzelinii</i>	<i>Anas melleri</i>
	<i>Ardea humbloti</i>	<i>Circus maillardi</i>
A2 (095)	East Malagasy wetlands EBA: One of the seven species of this EBA has been recorded at this site; see Table 2.	
A3 (A15)	East Malagasy biome: Two of the 45 species of this biome have been recorded at this site; see Table 3.	

■ Conservation issues

Intense soil erosion, caused by bush-fires, affects the surrounding deforested hills, and is infilling the wetlands and lowering their effective water-level. Local hunting and fishing may be having an impact on the ecology of the lakes.

■ Further reading

Danloux (1974), Le Bourdieu and Le Bourdieu (1966).

Loza Bay wetlands

Admin region Mahajanga
Coordinates 14°53'S 47°53'E
Area 60,700 ha Altitude 0–34 m

MG020

A1, A3 (A14)
Unprotected

■ Site description

Loza Bay lies between Analalava and Antsohihy and consists of a narrow 10-km-long estuary. The bay is 700–1,500 m wide and less than 10 m deep, except at its mouth where it can be 30 m deep at low tide. Towards the mouth, mangrove is weakly developed and sparse, growing on shingle-beaches in patches of c. 10 ha each. Mangrove is most developed (10 m high or more) where tributaries flow into the Bay. Rather large areas of intertidal mudflat fringe the mangrove. The banks are covered by dense, dry deciduous forest, mostly degraded, with savanna on those parts of the neighbouring hills which have not been eroded bare.

■ Birds

See Box and Table 3 for key species. Twenty species are known from the site, of which one is endemic to Madagascar. Several pairs of *Haliaeetus vociferoides* are known.

Key species

A1	<i>Haliaeetus vociferoides</i>
A3 (A14)	West Malagasy biome: One of the 24 species of this biome has been recorded at this site; see Table 3.

■ Other threatened/endemic wildlife

Cetacean: *Tursiops truncatus* (VU).

■ Conservation issues

Traditional fishing in the bay and deforestation in the neighbourhood can disturb waterbirds, in particular *Haliaeetus vociferoides*, since deforestation also reduces the number of available nest-trees.

■ Further reading

Langrand (1987), Rabarisoa (1994), Rabarisoa *et al.* (1995), Watson *et al.* (1993).

Port-Bergé wetlands

Admin region Mahajanga
Coordinates 15°25'S 47°44'E
Area 104,800 ha Altitude 50–80 m

MG021

A1, A2 (096), A3 (A14)
Unprotected

■ Site description

This vast complex of wetlands lies on the flood-plain of the Bemarivo river, and includes water-bodies near Mahajamba (Lakes

Andranolava, Mafana and Faly, and the Bekapila flood-plain), water-bodies near Port-Bergé (Lakes Besisika, Matsaborifanjava, Ampahaka and Ampombitika-Bezanadaoka—the only large and deep lake—and the Sofia river), and Lake Bekatra near Antsohihy. Lake-margin vegetation includes beds of *Cyperus* and reed *Phragmites*. Agriculture predominates in between the wetlands, particularly rice-fields, but there are also areas of dense, dry deciduous forest, savanna (sometimes with palms *Bismarckia*), and areas dominated by the non-native bush *Mimosa pudica*.

■ Birds

See Box and Tables 2 and 3 for key species. Sixty-eight species are known from the site, of which 14 are endemic to Madagascar. A nesting colony of *Mycteria ibis* is known from the region, and other species such as *Ardea humbloti* may nest locally.

Key species

A1	<i>Ardea humbloti</i>	<i>Anas bernieri</i>
A2 (096)	West Malagasy wetlands EBA: Three of the six species of this EBA have been recorded at this site; see Table 2.	
A3 (A14)	West Malagasy biome: Four of the 24 species of this biome have been recorded at this site; see Table 3.	

■ Conservation issues

Wild duck, e.g. *Dendrocygna viduata* and *D. bicolor*, are regularly hunted. The conversion of lake-margins to rice-fields also constitutes a threat.

■ Further reading

Evans *et al.* (1994).

Ankobohobo wetlands

Admin region Mahajanga
Coordinates 15°26'S 46°41'E
Area 3,750 ha Altitude 0–35 m

MG022

A1, A3 (A14)
Unprotected

■ Site description

The site consists of a small bay with a relatively low mangrove (8 m high), mudflats and some sand beaches. Some seasonal rivers flow into the bay. Around the mangrove, there are a few small patches of dry forest.

■ Birds

See Box and Table 3 for key species. Nineteen species are known from the site, of which one is endemic to Madagascar. Several pairs of *Haliaeetus vociferoides* nest at the site.

Key species

A1	<i>Ardea humbloti</i>	<i>Haliaeetus vociferoides</i>
A3 (A14)	West Malagasy biome: Two of the 24 species of this biome have been recorded at this site; see Table 3.	

■ Further reading

Rabarisoa (1994).

Mahajamba Bay wetlands

Admin region Mahajanga
Coordinates 15°28'S 46°55'S
Area 180,000 ha Altitude 0–40 m

MG023

A1, A2 (096), A3 (A14), A4i
Unprotected

■ Site description

This large bay is located 95 km north of Mahajanga. The bay is shallow and is generally less than 5 m deep at low tide, although the main drainage channel at its mouth is 20–90 m deep at low tide. Five rivers flow into the bay: the Sofia and the Tsiribihina rivers in the north-east, the Mahajamba river in the centre, and the Andranoboka and Masokoenja rivers in the south-east. There are 47,500 ha of mangroves, located at the mouths of the five rivers and dominated by *Rhizophora* and *Avicennia*. Those located along the sea are well developed (8–10 m high) and show no signs of exploitation. Tongue-shaped mudflats, c. 750 m long and 500 m wide, occur along the edge of the mangroves.

Some small rocky islets are present in the channel. Parts of the bay shore are rocky, and inland there are more or less wooded hills.

Birds

See Box and Tables 2 and 3 for key species. Thirteen species are known from the site, of which one is endemic to Madagascar. The site holds the largest congregation of *Egretta dimorpha* known.

Key species			
A1	<i>Ardea humbloti</i>	<i>Haliaeetus vociferoides</i>	
A2 (096)	West Malagasy wetlands EBA: Two of the six species of this EBA have been recorded at this site; see Table 2.		
A3 (A14)	West Malagasy biome: Two of the 24 species of this biome have been recorded at this site; see Table 3.		
A4i		Breeding (pairs)	Non-breeding
	<i>Egretta dimorpha</i>	—	447

Other threatened/endemic wildlife

Lemur: *Propithecus verreauxi coquereli* (EN).

Conservation issues

One of the rocky islets is a sacred site to which access is forbidden, and is this protected against human disturbance. *Haliaeetus vociferoides* and *Propithecus verreauxi coquereli* are also protected by 'fady' (taboos). The colonies of breeding waterbirds are exploited by local people, especially the employees of an industrial aquaculture installation.

Further reading

Langrand (1987), Rabarisoa (1994), Rabarisoa *et al.* (1995), Ségalen (1956), Watson *et al.* (1993).

Bombetoka Bay and Marovoay wetlands

MG024

Admin region Mahajanga

Coordinates 15°55'S 46°31'E

A1, A2 (096), A3 (A14), A4i

Area 148,200 ha Altitude 0–25 m

Unprotected

Site description

The site lies 20 km from Mahajanga. Bombetoka Bay is delimited, in the north, by a line from Katsepy in the west to the headland just north of Boanamaray in the east, and, in the south, by the Marovoay flood-plain. The bay consists of mangrove islets (c.43,500 ha) separated by channels (c.21,500 ha at high tide) and mudflats (c.8,500 ha at low tide), with shallow subtidal waters in the estuary. The water is shallow (less than 5 m deep at low tide), except towards the mouth, and is very turbid. Northern mangroves are relatively degraded (3–4 m high), while those toward the south are in better condition; likewise, those on the coast are more intact than those in brackish, inland areas, where the canopy is 6–8 m high. The largest mudflats lie immediately seaward of the mangrove islets. A muddy bar crosses the mouth of the estuary, c.10 m wide and covered with scattered mangroves. The Marovoay wetlands comprise a vast area of rice-fields, marshes with Cyperaceae, and a large reservoir, Lake Amboromalandy.

Birds

See Box and Tables 2 and 3 for key species. Sixty species are known from the site, of which 10 are endemic to Madagascar. The occurrence of a large, seasonal congregation of *Anas bernieri* (the largest known), and of several individuals of *Threskiornis (aethiopicus) bernieri*, in the Bombetoka estuary, is notable. The eastern part of Lake Amboromalandy is very rich in waterbirds.

Key species			
A1	<i>Tachybaptus pelzelinii</i>	<i>Anas bernieri</i>	
	<i>Ardea humbloti</i>	<i>Haliaeetus vociferoides</i>	
	<i>Phoenicopterus minor</i>		
A2 (096)	West Malagasy wetlands EBA: Three of the six species of this EBA have been recorded at this site; see Table 2.		
A3 (A14)	West Malagasy biome: Three of the 24 species of this biome have been recorded at this site; see Table 3.		
A4i		Breeding (pairs)	Non-breeding
	<i>Egretta dimorpha</i>	—	286
	<i>Casmerodius albus</i>	—	700
	<i>Anas bernieri</i>	—	85

Other threatened/endemic wildlife

Sirenian: *Dugong dugon* (VU; present, according to local people).

Conservation issues

Except near Mahajanga, the mangroves are relatively intact. A proposed plan for the industrialization and further development of Mahajanga city and harbour (for example, a proposal to set up shrimp-farms) includes potential pollution risks. Hunting, and the destruction of waterbird colonies on the Marovoay flood-plain, are both known threats.

Further reading

Delacour (1932), Hawkins (1993a), Langrand (1987), Rabarisoa (1994), Rabarisoa *et al.* (1995), Ségalen (1956), Thorstrom and Rabarisoa (1995), Watson *et al.* (1993).

Mahavavy delta wetlands

MG025

Admin region Mahajanga

Coordinates 16°00'S 45°42'E

A1, A2 (093, 096), A3 (A14), A4i

Area 258,900 ha Altitude 0–8 m

Unprotected

Site description

This site consists of Lake Kinkony (to the south of Mitsinjo town), the Mahavavy delta in the north, Marambitsy Bay in the west, and the Tsiombikibo Forest in the centre. The lake is 1–4 m deep and links to other satellite lakes during the rainy season, having a minimum area of 10,000 ha. The delta, limited by Cape Tanjona in the east and by Kingany village in the west, has an area of 33,700 ha, which includes c.16,000 ha of mangrove, c.5,200 ha of mudflats and c.12,500 ha of sea. The bay includes c.7,500 ha of mangrove islets, mudflats and marshes. The mangroves are dominated by *Avicennia* and *Rhizophora*. Near the sea they are well developed (8–10 m high), but further to the west and the east they are less dense and lower (5–6 m high). The permanent, but irregular, Mahavavy river feeds the lake and the delta. Smaller rivers, and streams from the Tsiombikibo Forest, flow into Marambitsy Bay. The lake vegetation includes vast reedbeds of *Phragmites* in the eastern part, and beds of *Cyperus* in adjacent areas. Tsiombikibo is a dense, dry deciduous forest, dominated by *Dalbergia*, *Erythrophleum couminga* and *Commiphora*. Other terrestrial areas are covered by dense grassland.

Birds

See Box and Tables 2 and 3 for key species. A total of 97 species have been recorded at the site, of which 26 are endemic to Madagascar. *Anas bernieri*, *Haliaeetus vociferoides* and *Amaurornis olivieri* have been seen at Lake Kinkony in the past, and c.10 *Anas bernieri* were seen recently on mudflats in the delta. However, these species are now no longer thought to occur in the lake. A large number of *Threskiornis (aethiopicus) bernieri*, probably a highly threatened species, is present on the delta, as is a large group of *Phoenicopterus ruber*.

Key species			
A1	<i>Ardea humbloti</i>	<i>Anas bernieri</i>	
	<i>Ardeola idae</i>	<i>Haliaeetus vociferoides</i>	
	<i>Phoenicopterus minor</i>		
A2 (093)	West Malagasy dry forests EBA: One of the six species of this EBA has been recorded at this site; see Table 2.		
A2 (096)	West Malagasy wetlands EBA: Three of the six species of this EBA have been recorded at this site; see Table 2.		
A3 (A14)	West Malagasy biome: Seven of the 24 species of this biome have been recorded at this site; see Table 3.		
A4i		Breeding (pairs)	Non-breeding
	<i>Phoenicopterus ruber</i>	—	4,200
	<i>Anas bernieri</i>	—	10
	<i>Sterna bengalensis</i>	—	2,523

Other threatened/endemic wildlife

Lemurs: *Eulemur mongoz* (VU), *Hapalemur griseus occidentalis* (VU), *Propithecus verreauxi deckeni* (VU), *P. verreauxi coronatus* (CR). Reptile: *Erymnochelys madagascariensis* (EN). Fish: *Paretroplus kieneri* (VU), *P. petiti* (CR).

Conservation issues

It is likely that three key wetland bird species, *Anas bernieri*, *Haliaeetus*

vociferoides and *Amaurornis olivieri*, are no longer present in Lake Kinkony, having been eliminated by a combination of excessive sedimentation, hunting and destruction of wetland habitat. Fishing has become increasingly commercial in the lake and this requires rational management to ensure the sustainability of fish-stocks. The conversion of mangrove and marshes to rice-fields, the hunting of birds on the mudflats and the exploitation of mangrove for firewood (to dry fish, etc.) also constitute threats.

Further reading

Decary (1932), Rand (1936), Tercinier (1952), Thiollay and Meyburg (1981), World Wide Fund for Nature–Madagascar (1997).

Baly Bay National Park

MG026

Admin region Mahajanga

 Coordinates 16°03'S 45°20'E A1, A2 (093, 096), A3 (A14), A4i
 Area 69,350 ha Altitude 0–100 m National Park

Site description

Baly Bay National Park is divided into four parcels with 10 core zones. The core zones cover 47,966 ha, with the remainder of the park being a buffer zone. Six of the core zones are located in the western part of the site. The three largest are Beheta (19,769 ha) and Cape Sada (1,192 ha) in the east, and a large part of the Amparafaka peninsula in the west. The terrain is gently undulating, with low hills and cliffs rising to c.80 m. There are many seasonal streams, two main permanent rivers, the Andranomavo and Kapiloza, and several permanent lakes, of which Lake Sariaka (c.300 ha) is the largest. The southern part of Baly Bay consists of mangrove, dominated by *Avicennia* and *Rhizophora*. The main lake vegetation is water-lilies *Nymphaea* and other floating plants. In flooded valleys and nearby a significant number of *Raphia* palms are present. Dry deciduous forest, dominated by *Dalbergia*, *Commiphora* and *Erythrophloeum couminga* (a very restricted-range tree species), is found mainly in the Tsiombikibo and Ambinda region, with remaining areas covered mainly in secondary vegetation of savanna with *Bismarckia* palms, or *Hyphaene* palms in humid valleys, or, on the hills, a rather characteristic formation composed of clumps of bamboo, mainly *Perrierbambo madagascariensis*. The tortoise *Geochelone yniphora* lives in these clumps, mainly at Cape Sada and Antsokotsoko, with a small surviving population in Beheta and Betainalika.

Birds

See Box and Tables 2 and 3 for key species. A total of 118 species are known from the area, of which 35 are endemic to Madagascar. Lake Sariaka holds a few pairs of *Haliaeetus vociferoides* and a colony of breeding waterbirds that includes *Platalea alba*, *Mycteria ibis*, *Ardea cinerea*, *Ardea humbloti* and *Threskiornis (aethiopicus) bernieri*. The mudflats, lagoons, bay and west coast of the Ampasindava peninsula hold species such as *Haliaeetus vociferoides*, *Threskiornis (aethiopicus) bernieri* and *Charadrius thoracicus*. During the summer, there is a gathering of 10,000 terns near Cape Amparafaka, mainly composed of *Sterna bengalensis* and *Sterna hirundo*.

Key species

A1	<i>Tachybaptus pelzelii</i>	<i>Anas bernieri</i>
	<i>Ardea humbloti</i>	<i>Haliaeetus vociferoides</i>
	<i>Ardeola idae</i>	<i>Charadrius thoracicus</i>
	<i>Lophotibis cristata</i>	
A2 (093)	West Malagasy dry forests EBA: One of the six species of this EBA has been recorded at this site; see Table 2.	
A2 (096)	West Malagasy wetlands EBA: Five of the six species of this EBA have been recorded at this site; see Table 2.	
A3 (A14)	West Malagasy biome: Nine of the 24 species of this biome have been recorded at this site; see Table 3.	
A4i	Breeding (pairs)	Non-breeding
	<i>Sterna bengalensis</i>	— 5,000
	<i>Charadrius thoracicus</i>	— 19

Other threatened/endemic wildlife

Lemurs: *Microcebus myoxinus* (VU), *Haplemur griseus occidentalis* (VU), *Propithecus verreauxi deckeni* (VU), *Daubentonia madagascariensis* (EN). Carnivores: *Cryptoprocta ferox* (VU), *Eupleres goudoti* (EN). Cetacean: *Sousa chinensis* (DD). Sirenian: *Dugong*

dugon (VU). Reptiles: *Chelonia mydas* (EN), *Lepidochelys olivacea* (EN), *Geochelone yniphora* (EN; the world population is confined to the national park).

Conservation issues

The Soalala region is the distribution area of an endemic tortoise, the angonoka *Geochelone yniphora*, which has been a flagship species for the Durrell Wildlife Conservation Trust (DWCT) since 1983. The approach adopted by DWCT has resulted in much progress being made in the sustainable development of natural resources. Lake Sariaka is protected by several taboos, in particular taboos against the use of boats and nets. Threats include conversion of wetlands to rice-fields, duck-hunting and the taking of waterbird eggs (except at Lake Sariaka). Recently, the development of commercial fishing, especially for shrimps, has reduced the catches of traditional fishermen, and exploitation of sea-cucumbers and shark-fins has become almost excessive. There is also a proposal for shrimp-farming in the area. The forests of the park have been significantly degraded by logging (for local and commercial purposes) and by the burning of savanna, which have apparently contributed to the complete destruction of Antsakoamileka Forest. Fishermen from the Kajemby clan hunt the *Dugong dugon* and marine turtles. In a few areas, *Eulemur fulvus rufus* is hunted.

Further reading

Curl *et al.* (1985), Decary (1932), Durbin *et al.* (1996), Hawkins (1994), Hawkins (1994a, b, c, 1995b, c, 1996), Hawkins and de Valois (1993), Hawkins *et al.* (1995), Langrand (1987), Nicoll and Langrand (1989), Rabarisoa *et al.* (1995), Rand (1936), Reid (1992), Reid *et al.* (1995), Watson *et al.* (1993).

Ankarafantsika Strict Nature Reserve and Ampijoroa Forestry Station

MG027

Admin region Mahajanga

A1, A2 (093), A3 (A14)

Coordinates 16°14'S 46°54'E

Strict Nature Reserve,

Area 135,000 ha Altitude 80–333 m

Forestry Station

Site description

The site is located on the Route Nationale 4, 40 km north-west of Ambato-Boeni. This complex of protected areas is centred on an outcrop of calcareous rock, lying c.250 m above the neighbouring plains (which are 60–90 m above sea-level). The site's eastern and southern limits slope down abruptly but the northern and western parts are less steep. The Mahajamba river flows along the north-eastern boundary of the reserve. The site includes several lakes, such as Lake Ravelobe in the eastern part of Ampijoroa Forestry Station. Dry forest covers most of the site, with numerous trees of Leguminosae, Myrtaceae and Passifloraceae. Xerophytes such as *Pachypodium* can also be found.

Birds

See Box and Tables 2 and 3 for key species. One hundred and fifteen species are known from the site, of which 41 are endemic to Madagascar. At least five pairs of *Haliaeetus vociferoides* breed at the site. Ankarafantsika is one of only two sites known for *Xenopirostris damii*, and one of only six sites known for *Mesitornis variegata*. The total population of the latter species at the site has been estimated at between 6,000 and 26,000. *Tachybaptus pelzelii* and *Ardea humbloti* are regular non-breeding visitors, and about 20 pairs of *Ardeola idae* breed at Lake Ravelobe. *Lophotibis cristata* and *Philepitta schlegeli* are both fairly common, the latter being restricted to humid valleys. *Alectroenas madagascariensis*, normally a species confined to the East Malagasy biome, is sometimes recorded here. There have been recent records of *Hypositta corallirostris* which, if confirmed, would be the first record of this species outside the east.

Key species

A1	<i>Tachybaptus pelzelii</i>	<i>Accipiter madagascariensis</i>
	<i>Ardea humbloti</i>	<i>Accipiter henstii</i>
	<i>Ardeola idae</i>	<i>Mesitornis variegata</i>
	<i>Lophotibis cristata</i>	<i>Philepitta schlegeli</i>
	<i>Haliaeetus vociferoides</i>	<i>Xenopirostris damii</i>
A2 (093)	West Malagasy dry forests EBA: Four of the six species of this EBA have been recorded at this site; see Table 2.	
A3 (A14)	West Malagasy biome: Nine of the 24 species of this biome have been recorded at this site; see Table 3.	

Other threatened/endemic wildlife

Lemurs: *Microcebus ravelobensis* (only known from here), *Eulemur mongoz* (VU), *Avahi occidentalis* (VU), *Propithecus verreauxi coquereli* (EN). Carnivore: *Cryptoprocta ferox* (VU). Rodent: *Macrotarsomys ingens* (CR). Reptiles: *Erymnochelys madagascariensis* (EN), *Boa madagascariensis* (VU), *B. manditra* (VU).

Conservation issues

Threats at this site include uncontrolled bush-fires, slash-and-burn cultivation, and illegal exploitation of wood.

Further reading

Andreone (1994), Andriamampianina and Peyrieras (1972), Andrianarimisa (1993), Collar and Stuart (1988), Eguchi *et al.* (1993), Hawkins (1993b, 1994c, d), Hino (1998), Jenkins (1987), Langrand (1987), Nicoll and Langrand (1989), Petter and Andriatsarafara (1987), Rabarisoa *et al.* (1995), Ramangason (1986), Thiollay and Meyburg (1981), Urano *et al.* (1992), Watson *et al.* (1993), Yamagishi *et al.* (1995).

Cape Saint André Forest and wetlands

MG028

Admin region Mahajanga

Coordinates 16°16'S 44°43'E

A1, A2 (093, 096), A3 (A14)

Area 90,110 ha Altitude 0–40 m

Unprotected

Site description

The site is located about 70 km north-east of Besalampy. The relief is low and soils are sandy. Habitats include forest, lakes and mangrove. The forest area is composed of dense, dry deciduous forest with a high, closed canopy, dominated by *Dalbergia* and bordered, in the east, by savanna. The savanna is wooded with palms *Bismarckia*, screw-pine *Pandanus*, *Albizia* and tamarind *Tamarindus*. Lake-margin vegetation includes water-lilies (Nymphaeaceae), legumes (Leguminosae), sedges (Cyperaceae), screw-pines (Pandanaaceae) and grasses (Gramineae). The mangrove is dominated by trees of *Rhizophora*, *Avicennia*, *Sonneratia* and *Ceriops*.

Birds

See Box and Tables 2 and 3 for key species. Seventy-eight species are known from the site, of which 27 are endemic to Madagascar. The avifauna is a mixture of forest birds and waterbirds.

Key species

 A1 *Tachybaptus pelzelii* *Haliaeetus vociferoides*
Lophotibis cristata

A2 (093) West Malagasy dry forests EBA: One of the six species of this EBA has been recorded at this site; see Table 2.

A2 (096) West Malagasy wetlands EBA: Two of the six species of this EBA have been recorded at this site; see Table 2.

A3 (A14) West Malagasy biome: Five of the 24 species of this biome have been recorded at this site; see Table 3.

Other threatened/endemic wildlife

Lemur: *Hapalemur griseus occidentalis* (VU). Reptile: *Boa madagascariensis* (VU).

Conservation issues

Threats include deforestation (5% of the forest has already been cut), conversion to rice-fields of wetlands or their margins, collection of edible tubers and wild honey, and hunting.

Further reading

Decary (1932), Rossi (1977).

Marotandrano Special Reserve

MG029

Admin region Mahajanga

Coordinates 16°23'S 48°44'E

A1, A2 (094), A3 (A15)

Area 42,200 ha Altitude 700–1,200 m

Special Reserve

Site description

Marotandrano Special Reserve is located south of the town of

Marotandrano, 4 km south of Mandritsara. The main rivers which rise in the area are the Amboabo, Andranokelilalina and Andramy, which flow to the Indian Ocean, and the Vatolahy and Mahatsara, which flow to the Mozambique Channel. The vegetation is mid-altitude, dense, humid evergreen forest, lying at the western limit of such habitat. Trees of *Tambourissa*, *Dalbergia*, *Onchostemum* and *Canarium* dominate the upper layer, while the mid-stratum is characterized by tree-ferns, bamboo-lianas and palms. On the ridges, the lower vegetation layer is dense and characterized by thick grass clumps.

Birds

See Box and Tables 2 and 3 for key species. Among the 76 recorded species, two are little known—*Eutriorchis astur* and *Tyto soumagnei*—and 49 are endemic to Madagascar.

Key species

 A1 *Ardeola idae* *Neodrepanis hypoxantha*
Lophotibis cristata
Phyllastrephus cinereiceps
Eutriorchis astur
Monticola sharpei
Accipiter madagascariensis
Hartertula flavoviridis
Accipiter henstii
Crossleyia xanthophrys
Mesitornis unicolor
Dromaeocercus brunneus
Tyto soumagnei
Randia pseudozosterops
Atelornis pittoides
Pseudobias wardi
Atelornis crossleyi

A2 (094) East Malagasy wet forests EBA: 12 of the 20 species of this EBA have been recorded at this site; see Table 2.

A3 (A15) East Malagasy biome: 30 of the 45 species of this biome have been recorded at this site; see Table 3.

Other threatened/endemic wildlife

Lemurs: *Eulemur rubriventer* (VU), *Varecia variegata variegata* (EN), *Propithecus diadema diadema* (EN), *Indri indri* (EN).

Conservation issues

Slash-and-burn cultivation and hunting of lemurs are likely to constitute threats. However, the forest remains mostly intact.

Further reading

ZICOMA (1999).

Namoroka Tsingy Strict Nature Reserve

MG030

Admin region Mahajanga

Coordinates 16°28'S 45°21'E

A1, A2 (093), A3 (A14)

Area 21,742 ha Altitude 71–227 m

Strict Nature Reserve

Site description

Namoroka Tsingy Strict Nature Reserve lies 55 km south of Soalala. Most of the site comprises a raised karst plateau, divided by gorges and limited on all sides by 30-m-high cliffs, similar to the Bemaraha Tsingy, 250 km to the south. There are four small permanent rivers, the Ambatofolaka, Mandevy, Andriabe and Ambararata, as well as various temporary streams. Permanent and temporary pools are located in the caves and caverns within the karst. During the dry season, the plateau is an important hydrological reservoir for the surrounding area. Dense, dry semi-deciduous forest covers c.50% of the reserve, especially in the gorges and on the periphery of the plateau. The karst plateau itself is covered by xerophilous bushland, dominated by *Euphorbia*, *Pachypodium* and baobabs *Adansonia*. The plateau is surrounded by slightly undulating ground, mainly covered by savanna (with palms *Bismarckia*) which is highly degraded due to annual burning for pasture. Gallery forests line the rivers flowing through the savanna, with screw-pines *Pandanus* prominent.

Birds

See Box and Tables 2 and 3 for key species. Sixty-three species are known from the site, of which 28 are endemic to Madagascar. *Philepitta schlegeli* is quite common, while *Alectroenas madagascariensis*, a species normally confined to the East Malagasy biome, can be found on rare occasions.

Key species

A1	<i>Tachybaptus pelzelinii</i> <i>Ardeola idae</i> <i>Lophotibis cristata</i>	<i>Accipiter madagascariensis</i> <i>Philepitta schlegeli</i>
----	--	--

A2 (093) West Malagasy dry forests EBA: Two of the six species of this EBA have been recorded at this site; see Table 2.

A3 (A14) West Malagasy biome: Six of the 24 species of this biome have been recorded at this site; see Table 3.

Other threatened/endemic wildlife

Lemurs: *Phaner furcifer pallescens* (VU), *Propithecus verreauxi deckeni* (VU). Carnivore: *Cryptoprocta ferox* (VU). Reptiles: *Boa madagascariensis* (VU), *Brookesia bonsi* (endemic to the site).

Conservation issues

The burning of pastures, bush-fires, illegal exploitation for construction wood, collection of medicinal plants, fishing and poaching together pose severe threats to the site.

Further reading

Andriamampianina and Peyrieras (1972), Hawkins (1994e), Jenkins (1987), Nicoll and Langrand (1989), Rand (1936), Reid and Hawkins (1993), Thalmann and Rakotoarison (1994).

Maevatanana–Ambato-Boeni wetlands MG031

Admin region Mahajanga

Coordinates 16°35'S 46°56'E

A1, A2 (096), A3 (A14)

Area 10,000 ha Altitude 38–100 m

Unprotected

Site description

The site consists of Lakes Ambanja, Vasily, Belongo and Manapatanana, located near Ambato-Boeni, and of Lakes Amparihibe, Mangabe, Bekopoly, Ambariasara and Bevoatavo, in the area of Maevatanana. The general area consists of a number of very large depressions, mainly covered (near Ambato-Boeni) by seasonal marshes which have been converted to rice-fields and other cultivation, and (near Maevatanana) by marshes and lakes. The main rivers are the Kamoro river, which flows across the Ambato-Boeni area, and the Betsiboka river, which flows west from Ambato-Boeni then south towards Maevatanana and which feeds the south of this area. The vegetation of the lakes includes beds of *Cyperus*, reedbeds of *Phragmites*, floating expanses of water-lily *Nymphaea*, non-native water-hyacinth *Eichhornia* and water-fern *Azolla*. On adjacent hills there are bushes of *Zizyphus* and *Strychnos*.

Birds

See Box and Tables 2 and 3 for key species. Thirty-four species are known from the site, of which three are endemic to Madagascar. *Haliaeetus vociferoides* is recorded infrequently, and *Aythya innotata* has been recorded in the past. Populations of *Ardea humbloti* and *Tachybaptus pelzelinii* are probably quite high, although nesting colonies of larger waterbirds in particular remain to be identified.

Key species

A1	<i>Tachybaptus pelzelinii</i> <i>Ardea humbloti</i>	<i>Haliaeetus vociferoides</i>
----	--	--------------------------------

A2 (096) West Malagasy wetlands EBA: Three of the six species of this EBA have been recorded at this site; see Table 2.

A3 (A14) West Malagasy biome: Two of the 24 species of this biome have been recorded at this site; see Table 3.

Other threatened/endemic wildlife

Reptile: *Erymnochelys madagascariensis* (EN).

Conservation issues

Over-exploitation of fish-stocks, poaching, and conversion of lake-edge habitat to rice-fields all threaten the ecological integrity of the site.

Further reading

Decary (1932), Moureau (1956), Pidgeon (1996), Tercinier (1952).

Mangoza Special Reserve
MG032

Admin region Mahajanga

Coordinates 16°55'S 44°44'E

A2 (093), A3 (A14)

Area 7,900 ha Altitude 0–150 m

Special Reserve

Site description

The site is located 50 km south-east of Besalampy. The relief is slightly undulating. The fast-flowing Mangoza river runs through the forest. The reserve includes dense, dry deciduous forest and secondary savanna. The forest is dominated by trees of *Dalbergia*, *Givottia*, *Securinega*, *Commiphora*, *Eugenia* and *Ravensara*. The mid-stratum is composed of small shrubs, numerous lianas and some epiphytes. There are palms *Hyphaene* and *Bismarckia* in the savanna.

Birds

See Box and Tables 2 and 3 for key species. As with Bemarivo Special Reserve (IBA MG033), Mangoza Special Reserve is still rather poorly known ornithologically. However, 52 species are known from the site, of which 25 are endemic to Madagascar. Species of global conservation concern include *Philepitta schlegeli*.

Key species

A2 (093) West Malagasy dry forests EBA: One of the six species of this EBA has been recorded at this site; see Table 2.

A3 (A14) West Malagasy biome: Six of the 24 species of this biome have been recorded at this site; see Table 3.

Other threatened/endemic wildlife

Lemurs: *Haplemur griseus occidentalis* (VU), *Propithecus verreauxi deckeni* (VU). Carnivore: *Cryptoprocta ferox* (VU).

Conservation issues

Threats to the site include deforestation, cutting of hardwood trees for construction of pirogues, and collection of wild honey.

Further reading

ZICOMA (1999).

Bemarivo Special Reserve
MG033

Admin region Mahajanga

Coordinates 16°56'S 44°23'E

A2 (093), A3 (A14)

Area 12,080 ha Altitude 25–80 m

Special Reserve

Site description

The site is located 11 km from Besalampy, on a coastal plateau. Within the reserve, the Bemarivo river is permanent while the small tributaries of the Marotondro river are seasonal. The main vegetation is dense, dry deciduous forest, dominated by trees of *Ravensara*, *Dalbergia*, *Cordyla*, *Sideroxylon*, *Grewia*, *Diospyros* and *Eugenia*. Outside the forest, there is secondary savanna with palms *Bismarckia*.

Birds

See Box and Tables 2 and 3 for key species. Sixty species are known from the site, of which 23 are endemic to Madagascar. However, the bird fauna of this forest is still poorly known and it is likely that other species remain to be discovered. Species of global conservation concern include *Lophotibis cristata* and *Philepitta schlegeli*.

Key species

A2 (093) West Malagasy dry forests EBA: Two of the six species of this EBA have been recorded at this site; see Table 2.

A3 (A14) West Malagasy biome: Five of the 24 species of this biome have been recorded at this site; see Table 3.

Other threatened/endemic wildlife

Lemur: *Propithecus verreauxi deckeni* (VU). Carnivore: *Cryptoprocta ferox* (VU).

Conservation issues

Threats include hunting, illegal exploitation of wood, and collection of forest products.

Further reading

ZICOMA (1999).

Kasijy Special Reserve

MG034

Admin region Mahajanga

Coordinates 17°03'S 45°55'E

A2 (093), A3 (A14)

Area 18,800 ha Altitude 120–450 m

Special Reserve

Site description

Kasijy Special Reserve is located 20 km north-west of Bemonto. The site comprises two forested outcrops of karst: the Kasijy massif and the small Analamajera massif. Three rivers delimit the site: the Andranomaitso river in the north, the Mahavavy river in the east and the Mahiarere river in the south. In the west, the site is bounded by a line from the Mahavavy river to the source of the Andranomaitso. In the north, the forest is dense, semi-deciduous and dry, with trees of *Adansonia*, *Cedrelopsis* and *Hildegardia* dominating. An area of savanna, with some woody species, is located in the southern part.

Birds

See Box and Tables 2 and 3 for key species. Fifty-four species are known from the site, of which 27 are endemic to Madagascar. Species of global conservation concern include *Accipiter henstii* and *Philepitta schlegeli*.

Key species

A2 (093) West Malagasy dry forests EBA: Two of the six species of this EBA have been recorded at this site; see Table 2.

A3 (A14) West Malagasy biome: Five of the 24 species of this biome have been recorded at this site; see Table 3.

Other threatened/endemic wildlife

Lemurs: *Phaner furcifer pallescens* (VU), *Propithecus verreauxi deckeni* (VU). Carnivore: *Cryptoprocta ferox* (VU). Reptile: *Erymnochelys madagascariensis* (EN).

Conservation issues

Cattle-grazing is a threat to the whole site.

Further reading

Hirsh (1998).

Tambohorano wetlands

MG035

Admin region Mahajanga

Coordinates 17°28'S 44°06'E

A1, A2 (096), A3 (A14), A4i

Area 8,300 ha Altitude 0–5 m

Unprotected

Site description

The site lies on the west coast of Madagascar, and consists of the mangrove located south-east of the town of Tambohorano, a portion of the adjacent coastal area, an offshore island (Nosy Vao), and Lakes Mandrozo and Manapape, located respectively 35 km west and 15 km south-east of the town. Lake Manapape (also called Andranovoribe) lies near the village of Andranovao. The mangrove extends south to the mouth of the Manambaho river and north to the north of Tambohorano. It is relatively dense, dominated by *Avicennia*, and is surrounded by vast coastal mudflats. The lakes are natural, with clear water. Lake Mandrozo is 2–3 m deep, while Lake Manapape is shallower. Seasonal marshes develop on the periphery of Lake Mandrozo when it floods. There are several islets in this lake, the largest of which is in the middle. Marginal vegetation at Lake Manapape includes abundant *Cyperus*, as well as *Mimosa pudica* and floating expanses of water-lily *Nymphaea* and water-hyacinth *Eichhornia*. Lake Manapape has very good fish-stocks. Both lakes are surrounded by savanna with palms *Hyphaene*. Nosy Vao is covered in savanna with some palms *Hyphaene* in the central part of the island; offshore there are coral reefs.

Birds

See Box and Tables 2 and 3 for key species. Eighty-two species are known from the site, of which 20 are endemic to Madagascar. A relatively large number of *Anas bernieri* breed in the Tambohorano

mangroves, representing perhaps 10% of the world population. Large and significant numbers of terns (Sterninae) roost on the reefs off Nosy Vao at low tide; most or all seem to be only passing through, before the breeding season.

Key species

A1	<i>Ardea humbloti</i>	<i>Haliaeetus vociferoides</i>
	<i>Anas bernieri</i>	<i>Charadrius thoracicus</i>
A2 (096)	West Malagasy wetlands EBA: Five of the six species of this EBA have been recorded at this site; see Table 2.	
A3 (A14)	West Malagasy biome: Six of the 24 species of this biome have been recorded at this site; see Table 3.	
A4i	Breeding (pairs)	Non-breeding
	<i>Anas bernieri</i>	— 67
	<i>Charadrius thoracicus</i>	— 61
	<i>Sterna bengalensis</i>	— 3,200
	<i>Sterna dougallii</i>	— 883

Other threatened/endemic wildlife

Lemur: *Propithecus verreauxi deckeni* (VU).

Conservation issues

Most of the communities neighbouring the lakes live by net-fishing, hunting of aquatic birds and rice-growing, which activities represent threats. In addition, the spread of non-native aquatic plants (*Eichhornia* and *Mimosa pudica*) threatens to reduce the importance of the site for birds. However, various taboos constitute a partial protection for the site. Fishermen visit Nosy Vao between August and November to fish for sharks, but do not represent a threat to birds.

Further reading

Berkelman (1997).

Iles Barren complex

MG036

Admin region Mahajanga

Coordinates 18°19'S 43°56'E

A1, A3 (A14), A4i

Area 172 ha Altitude 0–10 m

Unprotected

Site description

This site is located 10–30 km offshore of Maintirano, and includes the Iles Barren archipelago and the island of Nosy Marify. The archipelago comprises seven islets: Mavony, Lava, Andrano, Mangily, Dondosy, Androtra and Maroantaly. Most are covered in savanna with scattered trees and palms *Hyphaene*, but some are covered by *Casuarina* woodland. Nosy Mavony (Nosimborona) has very few trees but has a good cover of herbaceous plants such as *Ipomoea*. Nosy Dondosy, which ends with a rather abrupt cliff at its southern tip, is inhabited by fishermen. According to local information, Nosy Mangily remains uninhabited. Nosy Marify is located 17 km west from Maintirano. A small part of it is covered by *Ipomoea*.

Birds

See Box and Table 3 for key species. Twenty-one species are known from the site, of which one is endemic to Madagascar. A total of 1,480 pairs of *Sterna dougallii* were counted during a recent visit, of which 1,400 were on Nosy Mavony, where they were nesting with c.100 *Sterna anaethetus*. In 1982, there were c.2,000 pairs of *Sterna dougallii* at the site. *Ardea humbloti* has been recorded on Nosy Dondosy and Nosy Mangily.

Key species

A1	<i>Ardea humbloti</i>	
A3 (A14)	West Malagasy biome: One of the 24 species of this biome has been recorded at this site; see Table 3.	
A4i	Breeding (pairs)	Non-breeding
	<i>Sterna dougallii</i>	1,480 —

Conservation issues

The resident fishermen collect the eggs of nesting birds, with the result that very few young birds hatch.

Further reading

Langrand (1990).

Bemaraha Tsingy National Park and Strict Nature Reserve
MG037

Admin region Mahajanga A1, A2 (093, 096), A3 (A14)
 Coordinates 18°39'S 44°45'E National Park, Strict Nature Reserve,
 Area 152,000 ha Altitude 150–838 m World Heritage Site

Site description

Bemaraha Tsingy National Park and Strict Nature Reserve are located 60–80 km inland of the west coast of Madagascar. They are delimited to the south by the Manambolo river, to the east by a cliff, to the west by savanna, and to the north by the Soahany river. The western part of the site comprises a raised, heavily eroded karst plateau (Bemaraha Tsingy), with elongate sink-holes and deep canyons. Several permanent rivers and some seasonal streams flow out of the karst into the Soahany and Manambolo rivers. The vegetation is dense, dry deciduous forest, although, where the soil is humid, the forest has been degraded and, in the sink-holes and canyons, the forest is more evergreen, with trees higher than 12 m on average and a thick layer of leaf-litter. The non-forested part of the site, away from the karst, is savanna, with gallery forest lining the more permanent watercourses.

Birds

See Box and Tables 2 and 3 for key species. Ninety-six species are known from the site, of which 39 are endemic to Madagascar. Populations of *Canirallus* and *Monticola* at the site probably represent distinct species, restricted to the reserve.

Key species

A1	<i>Tachybaptus pelzelii</i>	<i>Circus maillardi</i>
	<i>Ardeola idae</i>	<i>Accipiter madagascariensis</i>
	<i>Lophotibis cristata</i>	<i>Accipiter henstii</i>
	<i>Haliaeetus vociferoides</i>	<i>Philepitta schlegeli</i>
A2 (093)	West Malagasy dry forests EBA: Two of the six species of this EBA have been recorded at this site; see Table 2.	
A2 (096)	West Malagasy wetlands EBA: One of the six species of this EBA has been recorded at this site; see Table 2.	
A3 (A14)	West Malagasy biome: Six of the 24 species of this biome have been recorded at this site; see Table 3.	

Other threatened/endemic wildlife

Lemurs: *Mirza coquereli* (VU), *Phaner furcifer pallescens* (VU), *Hapalemur griseus occidentalis* (VU), *Avahi occidentalis* (VU), *Propithecus verreauxi deckeni* (VU). Carnivore: *Cryptoprocta ferox* (VU).

Conservation issues

There are areas of slash-and-burn cultivation in the Tsiandro sector and, in the south, the contact zone between the forest and the savanna has been converted to pasture. Exploitation for wood has had a very evident impact on the forest, especially along the oil-industry road and within the reserve. Other threats include hunting of lemurs, collection of forest plants for food and medicine, widespread cattle-grazing, and collection of fauna for trade.

Further reading

Andriamampianina and Peyrieras (1972), Bousquet and Rabetaliana (1992), Jenkins (1987), Leandri (1938), Nicoll and Langrand (1989), Rakotoarison *et al.* (1993), Ramanitra (1995a, 1997), Ramanitra *et al.* (1993), Rand (1936), Thalmann and Rakotoarison (1994).

Bemamba wetland complex
MG038

Admin region Mahajanga A1, A2 (093, 096), A3 (A14), A4i
 Coordinates 18°46'S 44°22'E
 Area 41,500 ha Altitude 2–5 m Unprotected

Site description

The site is located 60 km from Antsalova and 8 km from the Mozambique Channel. It comprises a vast complex of shallow lakes (less than 2 m deep) and marshes on alluvial soil, located to the west of the Bemaraha Tsingy National Park (IBA MG037). In the north and the east, the Beboka and Soahany rivers feed the complex. Water-bodies in the northern part are freshwater and seasonal, not holding water

after July, while the central and southern water-bodies are permanent but increasingly saline towards the south. The wetlands in the north have been converted to rice-fields, while the central area is almost entirely covered by very dense, 2-m-high beds of reed-mace *Typha*, and the southern area by *Typha*, rushes *Juncus*, aquatic grasses and reeds.

Birds

See Box and Tables 2 and 3 for key species. One hundred and thirteen species are known from the site, of which 31 are endemic to Madagascar. Bemamba is the only site recently known for *Amaurornis olivieri*, and it is also of primary importance for *Anas bernieri*. There are also large breeding colonies of other waterbirds. This is the only site which holds all of the restricted-range species characteristic of the western wetlands of Madagascar.

Key species

A1	<i>Ardea humbloti</i>	<i>Circus maillardi</i>
	<i>Phoenicopterus minor</i>	<i>Amaurornis olivieri</i>
	<i>Anas bernieri</i>	<i>Charadrius thoracicus</i>
	<i>Haliaeetus vociferoides</i>	<i>Philepitta schlegeli</i>
A2 (093)	West Malagasy dry forests EBA: Two of the six species of this EBA have been recorded at this site; see Table 2.	
A2 (096)	West Malagasy wetlands EBA: All six species of this EBA have been recorded at this site; see Table 2.	
A3 (A14)	West Malagasy biome: 11 of the 24 species of this biome have been recorded at this site; see Table 3.	
A4i		Breeding (pairs) Non-breeding
	<i>Ardea humbloti</i>	— 50
	<i>Egretta ardesiaca</i>	— 2,000
	<i>Casmerodius albus</i>	— 500
	<i>Plegadis falcinellus</i>	— 1,265
	<i>Anas bernieri</i>	— 30
	<i>Chlidonias hybridus</i>	— 600

Other threatened/endemic wildlife

Lemurs: *Hapalemur griseus occidentalis* (VU), *Propithecus verreauxi deckeni* (VU), *Phaner furcifer* (nt). Carnivore: *Cryptoprocta ferox* (VU). Reptile: *Erymnochelys madagascariensis* (EN).

Conservation issues

In 1990, a cyclone partially blocked the Soahany river and this significantly reduced the inflow of fresh water. The conversion of marshes to rice-fields, fishing, deforestation, and palm-wine production are responsible for the destruction of large areas of vegetation. This is exposing the lakes to increased sedimentation, resulting from soil erosion, which constitutes a serious threat to the wetlands and their fauna. There is also considerable pressure on large waterbird colonies through hunting and egg-collection.

Further reading

Andrianarimisa (1992), Green *et al.* (1994), Langrand (1987), Nicoll and Langrand (1989), Rabarisoa *et al.* (1995), Ramanampamonjy (1995), Safford (1993), Scott and Lubbock (1974), Watson *et al.* (1993), Young and Safford (1995), Young *et al.* (1993).

Manambolomaty wetland complex and Tsimembo Classified Forest
MG039

Admin region Mahajanga A1, A2 (093, 096), A3 (A14), A4i
 Coordinates 18°56'S 44°23'E
 Area 35,470 ha Altitude 7–80 m Classified Forest, Ramsar Site, Unprotected

Site description

Lakes Ankerika, Antsamaka, Soamalipo and Befotaka form the wetlands of the Manambolomaty complex, 35 km south-west of Antsalova, and are surrounded by the Tsimembo Forest. Lake Ankerika is located in the commune of Trangahy, and the three others in the commune of Masoarivo. Lakes Soamalipo and Befotaka are linked. The lakes lie on alluvial soils and most are freshwater and permanent, with a depth of 3–6 m depending on the season. Lake Antsamaka is brackish and 3 m deep during the rainy season, but may completely dry up at the end of the dry season. Aquatic vegetation at this lake includes water-lilies *Nymphaea* and rushes *Juncus*. In the southern part of the lakes, an area of 98 ha has been converted to

seasonal marshes and rice-fields. Tsimembo Forest is bounded by the Manambolomaty river in the south and by the Beboka river in the north, and consists of dense, dry deciduous forest. Dominant canopy trees include *Dalbergia*, *Stereospermum*, *Givotia*, *Xylia*, *Cordyla*, *Hildegardia*, *Delonix* and *Diospyros*. The mid-stratum is dominated by species of Rubiaceae, Euphorbiaceae and Leguminosae. On patches of much sandier soil (old sand-dunes), the forest canopy is lower and there are fewer emergents. The part of the Tsimembo Forest that surrounds Lake Antsamaka is called Ankotrofotsy Forest.

Birds

See Box and Tables 2 and 3 for key species. Ninety-three species are known from the site, of which 29 are endemic to Madagascar. The site holds 10 pairs of *Haliaeetus vociferoides*, representing c.10% of the world population. There is an islet which is a roosting and nesting site for herons (Ardeidae) such as *Ardea humbloti*, and for *Anas bernieri*.

Key species			
A1	<i>Ardea humbloti</i>	<i>Anas bernieri</i>	
	<i>Ardeola idae</i>	<i>Haliaeetus vociferoides</i>	
	<i>Lophotibis cristata</i>	<i>Accipiter henstii</i>	
	<i>Phoenicopterus minor</i>	<i>Charadrius thoracicus</i>	
A2 (093)	West Malagasy dry forests EBA: One of the six species of this EBA has been recorded at this site; see Table 2.		
A2 (096)	West Malagasy wetlands EBA: Five of the six species of this EBA have been recorded at this site; see Table 2.		
A3 (A14)	West Malagasy biome: Eight of the 24 species of this biome have been recorded at this site; see Table 3.		
A4i		Breeding (pairs)	Non-breeding
	<i>Ardea humbloti</i>	—	440
	<i>Platalea alba</i>	—	401
	<i>Anas bernieri</i>	—	35

Other threatened/endemic wildlife

Lemurs: *Phaner furcifer pallescens* (VU), *Haplemur griseus occidentalis* (VU), *Propithecus verreauxi dekeni* (VU). Carnivore: *Cryptoprocta ferox* (VU). Reptile: *Erynnochelys madagascariensis* (EN).

Conservation issues

The lakes, together with a strip of 1 km around them, form a Ramsar Site, pursuant to Law 98-003 of 19 February 1998. Lakes Soamalipo, Ankerika and Befotaka are mainly threatened by increasing sedimentation rates (following increased soil erosion) and by the conversion of marshes to rice-fields. Other threats include the burning of pastures, deforestation, and the illegal cutting of trees for firewood to dry fish, which has caused the number of nesting *Ardea humbloti* to decrease substantially in recent times.

Further reading

Langrand (1987), Rabarisoa *et al.* (1995), Ramanitra and Randrianasolo (1994), Ramanitra *et al.* (1993), Watson *et al.* (1993), World Wide Fund for Nature–Madagascar (1997).

Anjanaharibe Classified Forest

MG040

Admin region Toamasina

Coordinates 15°08'S 49°38'E

A1, A2 (094), A3 (A15)

Area 7,500 ha Altitude 450–1,140 m

Classified Forest

Site description

This forest lies 32 km north-west of Maroantsetra, north-east of Andaparaty-Ambinanitelo. The terrain is undulating, with steep slopes and high peaks making access difficult. Three main rivers, permanent and turbid, flow to the south-west of Anjanaharibe peak: the Ambalanirana, Antsahabe and Longozabe. The Ambalanirana river is a tributary of the Sahantaha river. Low- and mid-altitude, dense, humid evergreen forest covers the site, and is dominated by *Weinmannia*, *Canarium* and *Dalbergia*. Areas of previous slash-and-burn cultivation are overgrown by secondary thicket, dominated by *Harungana* trees, traveller's palm *Ravenala* and wild ginger *Aframomum*.

Birds

See Box and Tables 2 and 3 for key species. Seventy-one species are known from the site, of which 37 are endemic to Madagascar.

Key species

A1	<i>Ardeola idae</i>	<i>Atelornis crossleyi</i>
	<i>Lophotibis cristata</i>	<i>Neodrepanis hypoxantha</i>
	<i>Brachypteracias leptosomus</i>	<i>Oriolia bernieri</i>
	<i>Brachypteracias squamigera</i>	<i>Euryceros prevostii</i>
A2 (094)	East Malagasy wet forests EBA: Eight of the 20 species of this EBA have been recorded at this site; see Table 2.	
A3 (A15)	East Malagasy biome: 18 of the 45 species of this biome have been recorded at this site; see Table 3.	

Other threatened/endemic wildlife

Lemur: *Varecia variegata rubra* (CR).

Conservation issues

The main threat is slash-and-burn cultivation of hill-rice, but it is not yet much developed, e.g. affecting only 5% of the forest in the neighbourhood of Ambalanirana village. Another threat is the illegal exploitation of forest products.

Further reading

Andreone (1994), Langrand (1989), Projet COEFOR/CI SRF-DEF (1993), Rand (1936), Salomonsen (1934a, b).

Upper Rantabe Classified Forest

MG041

Admin region Toamasina

Coordinates 15°40'S 49°22'E

A1, A2 (094), A3 (A15)

Area 33,200 ha Altitude 300–700 m

Classified Forest

Site description

Upper Rantabe Classified Forest is located 90 km south-west of Maroantsetra. The terrain is a succession of mountains and valleys. The Vohilava river flows through the site, as do many permanent or seasonal streams. The vegetation is composed of intact and degraded low-altitude, dense, humid evergreen forest. The canopy layer of intact forest is composed of spur- and stilt-root trees 20–25 m high, dominated by *Dalbergia* and *Tambourissa*, while the mid-stratum is dominated by shrubs and abundant tree-ferns *Cyathea*, and the ground layer is formed of small plants and grasses. Secondary thickets in degraded forest are composed mainly of *Solanum* and *Lantana* bushes, and wild ginger *Aframomum*.

Birds

See Box and Tables 2 and 3 for key species. Eighty-two species are known from the site, of which 52 are endemic to Madagascar. All species of the Vangidae family characteristic of wet forests, and species characteristic of low-altitude forests, such as *Newtonia fanovanae* and *Brachypteracias squamigera*, are present at the site.

Key species

A1	<i>Ardeola idae</i>	<i>Oriolia bernieri</i>
	<i>Lophotibis cristata</i>	<i>Euryceros prevostii</i>
	<i>Eutriorchis astur</i>	<i>Monticola sharpei</i>
	<i>Accipiter henstii</i>	<i>Crossleyia xanthophrys</i>
	<i>Brachypteracias leptosomus</i>	<i>Randia pseudozosterops</i>
	<i>Brachypteracias squamigera</i>	<i>Newtonia fanovanae</i>
	<i>Atelornis pittoides</i>	<i>Pseudobias wardi</i>
	<i>Xenapiostris polleni</i>	
A2 (094)	East Malagasy wet forests EBA: 11 of the 20 species of this EBA have been recorded at this site; see Table 2.	
A3 (A15)	East Malagasy biome: 28 of the 45 species of this biome have been recorded at this site; see Table 3.	

Other threatened/endemic wildlife

Lemurs: *Varecia variegata* (EN), *Indri indri* (EN). Carnivore: *Fossa fossana* (EN).

Conservation issues

The site is threatened by forest clearance, hunting, exploitation for wood, and gem-mining.

Further reading

Projet COEFOR/CI SRF-DEF (1993), Stephenson (1987).

Mananara-North National Park
MG042

Admin region Toamasina

Coordinates 16°15'S 49°40'E

A1, A2 (094), A3 (A15)

Area 140,000 ha Altitude 0–570 m National Park, Biosphere Reserve

Site description

Mananara-North National Park lies 225 km north of Toamasina, situated in an area of coastal hills. The park includes a marine area. Shallow, clear, fast-flowing rivers flow through the area eastwards to the coast. The rivers have many sandbanks and a few islets. The park is covered in forest. On the sandy coastal plain, littoral forest is dominated by *Terminalia*, *Calophyllum*, *Canarium*, *Heritiera* and mangroves of *Rhizophora* and *Avicennia*. Inland, there is low-altitude, dense, humid evergreen forest with a canopy 30–35 m high, and emergents up to 40 m. Secondary grassland is found in some parts.

Birds

See Box and Tables 2 and 3 for key species. Eighty-two species are known from the site, of which 37 are endemic to Madagascar. Knowledge of the park's avifauna is still scanty, as the results of recent inventories are not yet available.

Key species

A1	<i>Tachybaptus pelzelii</i>	<i>Accipiter madagascariensis</i>
	<i>Ardeola idae</i>	<i>Brachypteracias leptosomus</i>
	<i>Lophotibis cristata</i>	<i>Brachypteracias squamigera</i>
A2 (094)	East Malagasy wet forests EBA: Three of the 20 species of this EBA have been recorded at this site; see Table 2.	
A3 (A15)	East Malagasy biome: 12 of the 45 species of this biome have been recorded at this site; see Table 3.	

Other threatened/endemic wildlife

Lemurs: *Allocebus trichotis* (CR), *Varecia variegata* (EN), *Indri indri* (EN), *Propithecus diadema diadema* (EN), *Daubentonia madagascariensis* (EN). Carnivores: *Galidictis fasciata* (VU), *Fossa fossana* (VU), *Salanoia concolor* (VU), *Eupleres goudotii* (EN), *Cryptoprocta ferox* (VU).

Conservation issues

Threats include slash-and-burn cultivation, exploitation for firewood and construction wood, collection of edible and medicinal plants, exploitation of forest trees, hunting, and collection of wild honey.

Further reading

Collar and Stuart (1988), Nicoll and Langrand (1989), Raondry *et al.* (1995).

Ambatovaky Special Reserve
MG043

Admin region Toamasina

Coordinates 16°45'S 49°15'E

A1, A2 (094), A3 (A15)

Area 60,500 ha Altitude 300–1,200 m Special Reserve

Site description

Ambatovaky Special Reserve is located about 50 km west of the coastal town of Soanierana-Ivongo. Many streams drain eastwards through the site and create innumerable small valleys and ridges between occasional steep-sloped, sharp-peaked mountains. Two main rivers flow through the reserve, the Iampirano and the Sandrangato. The vegetation is mainly dense, low- and mid-altitude, humid evergreen forest, with sclerophyllous montane forest in the higher areas.

Birds

See Box and Tables 2 and 3 for key species. Ninety-two species are known from the site, of which 55 are endemic to Madagascar. This is the only site known for *Mesitornis variegata* in the East Malagasy biome, and it is possible that this population is a separate taxon.

Key species

A1	<i>Ardeola idae</i>	<i>Eutriorchis astur</i>
	<i>Lophotibis cristata</i>	<i>Accipiter henstii</i>

A1 ... continued

<i>Mesitornis variegata</i>	<i>Oriolia bernieri</i>
<i>Mesitornis unicolor</i>	<i>Euryceros prevostii</i>
<i>Brachypteracias leptosomus</i>	<i>Monticola sharpei</i>
<i>Brachypteracias squamigera</i>	<i>Randia pseudozosterops</i>
<i>Atelornis pittoides</i>	<i>Newtonia fanovanae</i>
<i>Phyllastrephus cinereiceps</i>	

A2 (094) East Malagasy wet forests EBA: 11 of the 20 species of this EBA have been recorded at this site; see Table 2.

A3 (A15) East Malagasy biome: 27 of the 45 species of this biome have been recorded at this site; see Table 3.

Other threatened/endemic wildlife

Lemurs: *Eulemur rubriventer* (VU), *Varecia variegata variegata* (EN), *Indri indri* (EN), *Propithecus diadema diadema* (EN), *Daubentonia madagascariensis* (EN). Carnivores: *Fossa fossana* (VU), *Cryptoprocta ferox* (VU). Butterflies: *Papilio mangoura* (VU), *Amauris nossima* (VU).

Conservation issues

Slash-and-burn cultivation (especially in the lowland eastern sector), widespread cattle-grazing and poaching are severe threats to the site. Over-collection of medicinal plants and wild honey is also a risk.

Further reading

Evans (1991), Nicoll and Langrand (1989), Raxworthy and Colston (1992), Thompson and Evans (1991, 1992).

Bidia Classified Forest
MG044

Admin region Toamasina

Coordinates 16°51'S 48°44'E

A2 (094), A3 (A15)

Area 32,727 ha Altitude 800–1,200 m

Classified Forest

Site description

Bidia Classified Forest lies c.30 km north-east of Andilamena. The site is a network of mountains, peaking at Bidia (1,200 m), which is part of the Marovoalavo plateau. The hydrological network is dense and dominated by the Befiaka, Vakoanina and Bidia rivers. The primary vegetation is composed of mid-altitude, dense, humid evergreen forest (frequently 25–30 m high), dominated by trees of *Weinmannia*, *Dalbergia*, *Canarium* and *Eugenia*. There are also secondary formations of traveller's palm *Ravenala* and fallow areas dominated by *Solanum* and *Harungana*.

Birds

See Box and Tables 2 and 3 for key species. Sixty-two species are known from the site, of which 33 are endemic to Madagascar. Species characteristic of both low- and mid-altitudes occur. Species of global conservation concern include *Tachybaptus pelzelii*, *Atelornis pittoides*, *Dromaeocercus brunneus*, *Randia pseudozosterops* and *Pseudobias wardi*.

Key species

A2 (094)	East Malagasy wet forests EBA: Three of the 20 species of this EBA have been recorded at this site; see Table 2.	
A3 (A15)	East Malagasy biome: 14 of the 45 species of this biome have been recorded at this site; see Table 3.	

Other threatened/endemic wildlife

Lemurs: *Varecia variegata variegata* (EN), *Indri indri* (EN), *Propithecus diadema diadema* (EN). Carnivore: *Cryptoprocta ferox* (VU).

Conservation issues

Threats to the site include forest clearance, which has already affected 5–10% of the forest area, wood-cutting, commercial collection of medicinal plants such as kotofy (an aphrodisiac) and *Centella asiatica*, and fires.

Further reading

Projet COEFOR/CI SRF-DEF (1993).

Bezavona Classified Forest

MG045

Admin region Toamasina

Coordinates 16°57'S 48°58'E

A1, A2 (094, 095), A3 (A15)

Area 56,427 ha Altitude 600–1,100 m

Classified Forest

Site description

Bezavona Classified Forest is located 60 km north-west of Andilamena, at the extreme western limit of Madagascar's eastern forests. The site comprises a chain of mountains, with peaks at Bezavona (1,050 m) and Berangompanihy (1,080 m), Bezavona being part of the Marovoalavo plateau. The hydrological network is dense and dominated by the Antsahabero river in the east and in the south, and by the Manantsatrana and Fatakanina rivers in the east. The main vegetation is low- and mid-altitude, dense, humid evergreen forest with a closed canopy (20–30 m high), dominated by trees of *Oncostemum*, *Canarium*, Sapotaceae and Erythroxylaceae, as well as by dry-forest species such as *Capurodendron perrieri* and *Erythroxylum amplifolium*. Tree-ferns *Cyathea*, palms and bamboo-lianas are abundant in the understorey. Secondary vegetation is dominated by traveller's palm *Ravenala madagascariensis*.

Birds

See Box and Tables 2 and 3 for key species. Seventy-nine species are known from the site, of which 51 are endemic to Madagascar, including 11 members of the vanga (Vangidae) family.

Key species

A1	<i>Tachybaptus pelzelii</i>	<i>Xenopirostris polleni</i>
	<i>Ardeola idae</i>	<i>Oriolia bernieri</i>
	<i>Lophotibis cristata</i>	<i>Euryceros prevostii</i>
	<i>Anas melleri</i>	<i>Monticola sharpei</i>
	<i>Accipiter henstii</i>	<i>Hartertula flavoviridis</i>
	<i>Brachypteracias leptosomus</i>	<i>Crossleyia xanthophrys</i>
	<i>Atelornis pittoides</i>	<i>Randia pseudozosterops</i>
	<i>Phyllastrephus cinereiceps</i>	<i>Pseudobias wardi</i>
A2 (094)	East Malagasy wet forests EBA: 10 of the 20 species of this EBA have been recorded at this site; see Table 2.	
A2 (095)	East Malagasy wetlands EBA: One of the seven species of this EBA has been recorded at this site; see Table 2.	
A3 (A15)	East Malagasy biome: 27 of the 45 species of this biome have been recorded at this site; see Table 3.	

Other threatened/endemic wildlife

Lemurs: *Eulemur rubriventer* (VU), *Varecia variegata variegata* (EN), *Indri indri* (EN). Carnivore: *Fossa fossana* (VU).

Conservation issues

Threats to the site include forest clearance, which has already affected 5–10% of the forest area, wood-cutting, commercial collection of medicinal plants, fires, and the hunting of lemurs and birds.

Further reading

Projet COEFOR/CI SRF-DEF (1993).

Lake Alaotra

MG046

Admin region Toamasina

Coordinates 17°34'S 48°26'E

A1, A2 (095), A3 (A15), A4i

Area c.90,000 ha Altitude 750–790 m

Unprotected

Site description

This is the largest lake in Madagascar, situated 170 km north-east of Antananarivo and 7 km north of Ambatondrazaka. It lies in a tectonic basin 40 km long and 9.5 km wide, located between the Grand Angavo escarpment in the west and the Mangoro–Alaotra escarpment in the east. Its depth is 1.0–2.5 m during the low-water season and 4 m during the high-water season. The water is fresh, and turbid with suspended silt due to intense erosion of the deforested hills that surround the lake. The lake is fed by the Sasomanga and Sahabe rivers in the south, and by the Sahamaloto and Anony rivers in the north-west. The only drainage river, the Maningory, flows out of the north-eastern part of the lake. The lake-bottom sediments consist of thick layers of sand,

black mud and grey clay. Natural, permanent marshes occur along the lake margin, especially in the southern part of the site. The largest are located to the south and east of the Antanamalaza peninsula and in the part drained by the Maningory. There are also wet grasslands. The lake vegetation was formerly dominated by water-lilies *Nymphaea*, but these have decreased in extent due to competition with non-native water-hyacinth *Eichhornia* and water-fern *Salvinia*. In the marshes, sedges *Cyperus* and reeds *Phragmites* dominate. Secondary savanna covers the surrounding hills.

Birds

See Box and Tables 2 and 3 for key species. Eighty species are known from the site, of which 13 are endemic to Madagascar. Lake Alaotra is an exceptional site for waterbirds. It formerly held two highly threatened endemic species, which were probably confined to the lake, but which may now be extinct: *Tachybaptus rufolavatus* and *Aythya innotata*. The former was last recorded in 1985 and the latter in 1991. Furthermore, the flocks of *Anas melleri* that occur on the lake constitute the largest congregations known for this species, and *Ardea humbloti* also occurs regularly (in its only eastern site), though it is not proven to have bred.

Key species

A1	<i>Tachybaptus rufolavatus</i>	<i>Anas melleri</i>
	<i>Tachybaptus pelzelii</i>	<i>Aythya innotata</i>
	<i>Ardea humbloti</i>	<i>Circus maillardi</i>
	<i>Ardeola idae</i>	
A2 (095)	East Malagasy wetlands EBA: Five of the seven species of this EBA have been recorded at this site; see Table 2.	
A3 (A15)	East Malagasy biome: Five of the 45 species of this biome have been recorded at this site; see Table 3.	
A4i	<i>Anas melleri</i>	Breeding (pairs) Non-breeding
		— 150

Other threatened/endemic wildlife

Lemur: *Haplemur griseus alaotrensis* (CR). Carnivore: *Salanoia concolor* (VU).

Conservation issues

Human activities that pose a threat include the burning of marsh vegetation, poaching, intensive gill-netting, and conversion of marshes to rice-fields. The invasion of the lake by non-native vegetation, and the introduction of non-native fishes such as *Tilapia* and *Ophiocephalus*, have resulted in the loss of several native species of fish, waterbird and aquatic plant.

Further reading

Delacour (1930), Hawkins *et al.* (2000), Nicoll and Langrand (1989), Payne (1960), Pidgeon (1996), Rand (1936), Voous and Payne (1965), Wilmé (1993), World Wide Fund for Nature–Madagascar (1997), Young and Smith (1989).

Zahamena National Park

MG047

Admin region Toamasina

Coordinates 17°36'S 48°53'E

A1, A2 (094), A3 (A15)

Area 73,160 ha Altitude 254–1,560 m

National Park

Site description

Zahamena National Park is located 40 km north-east of Ambatondrazaka and 4 km from Manakambahiny-East. The terrain is very undulating, with several steep-sided valleys. The park is in two areas, west and east, partially separated by a large enclave which includes several villages. The valleys are drained by rivers, the most important of which are the Sahatavy and its tributary, the Sarondrina. A network of rivers in the north-west of the park flows into Lake Alaotra (IBA MG046). At low altitudes the dense, humid evergreen forest has a canopy 15–20 m high and 25-m-high emergents, typically with trees of *Tambourissa*, *Weinmannia*, *Diospyros*, *Ravensara* and *Dalbergia*. The shrub layer is dominated by tree-ferns *Cyathea* and screw-pines *Pandanus*. There are also areas of secondary forest. The dense, humid evergreen forest extends to mid-altitudes, above which there is dense, sclerophyllous montane forest. The forest on the slopes has a denser shrub and ground layer, dominated by herbs (*Impatiens*, *Begonia*) and ferns *Polystichum*.

Birds

See Box and Tables 2 and 3 for key species. A total of 109 species are known from the site, of which 67 are endemic to Madagascar. The only species characteristic of humid forest that is not yet known from the site is *Crossleyia xanthophrys*. The park is therefore the protected area with the largest number of endemic bird species in Madagascar.

Key species

A1	<i>Lophotibis cristata</i>	<i>Phyllastrephus tenebrosus</i>
	<i>Eutriorchis astur</i>	<i>Phyllastrephus cinereiceps</i>
	<i>Accipiter madagascariensis</i>	<i>Xenopirostris polleni</i>
	<i>Accipiter henstii</i>	<i>Oriolia bernieri</i>
	<i>Mesitornis unicolor</i>	<i>Euryceros prevostii</i>
	<i>Tyto soumagnei</i>	<i>Monticola sharpei</i>
	<i>Brachypteracias leptosomus</i>	<i>Hartertula flavoviridis</i>
	<i>Brachypteracias squamigera</i>	<i>Dromaeocercus brunneus</i>
	<i>Atelornis pittoides</i>	<i>Randia pseudozosterops</i>
	<i>Atelornis crossleyi</i>	<i>Newtonia fanovanae</i>
	<i>Neodrepanis hypoxantha</i>	<i>Pseudobias wardi</i>
A2 (094)	East Malagasy wet forests EBA: 19 of the 20 species of this EBA have been recorded at this site; see Table 2.	
A3 (A15)	East Malagasy biome: 37 of the 45 species of this biome have been recorded at this site; see Table 3.	

Other threatened/endemic wildlife

Lemurs: *Allocebus trichotis* (CR), *Phaner furcifer* (nt), *Eulemur rubriventer* (VU), *Varecia variegata* (EN), *Indri indri* (EN), *Propithecus diadema diadema* (EN), *Daubentonia madagascariensis* (EN). Carnivores: *Galidictis fasciata* (VU), *Salanoia concolor* (VU), *Cryptoprocta ferox* (VU), *Eupleres goudotii* (EN), *Fossa fossana* (VU). Reptile: *Boa manditra* (VU).

Conservation issues

Zahamena is one of the few protected areas to include low-altitude forest. Threats include slash-and-burn cultivation and hunting (in the centre, east and north) and fires and tree-cutting (in the west).

Further reading

Andriamampianina and Peyrieras (1972), Daniels (1991), Goodman and Schulenberg (1992), Hawkins (1995d), Hawkins *et al.* (in press), Jenkins (1987), Nicoll and Langrand (1989), Randriamanindy (1995), Thompson (1987).

Betampona Strict Nature Reserve

MG048

Admin region Toamasina

Coordinates 17°54'S 49°13'E

A1, A2 (094), A3 (A15)

Area 2,228 ha Altitude 300–590 m

Strict Nature Reserve

Site description

The site lies 35 km north-west of Toamasina and 4.5 km from Fontsimavo, being situated on a rocky foothill overlooking the coastal plain. It comprises a series of mountainous peaks with steep slopes. Small seasonal tributaries of the Ivoloina river cross the reserve, which is covered by low-altitude, dense, humid evergreen forest, typically with trees of *Dalbergia*, *Ilex*, *Tambourissa* and *Canarium*, and tree-ferns *Cyathea*. Screw-pines *Pandanus*, tree lianas and bamboo-lianas *Nastus* are abundant. Secondary woodlands and thickets (in degraded areas of forest) cover 30–35% of the site, and are dominated by fast-growing species such as traveller's palm *Ravenala*, bushes of *Solanum* and *Lantana*, and wild ginger *Aframomum*.

Birds

See Box and Tables 2 and 3 for key species. Seventy-seven species are known from the site, of which 51 are endemic to Madagascar. Four of the species are confined mainly to the north-eastern forests of Madagascar: *Coua serriana*, *Brachypteracias squamigera*, *Oriolia bernieri* and *Euryceros prevostii*. All species of *Coua* characteristic of humid forest are present.

Key species

A1	<i>Lophotibis cristata</i>	<i>Brachypteracias leptosomus</i>
	<i>Accipiter madagascariensis</i>	<i>Brachypteracias squamigera</i>
	<i>Accipiter henstii</i>	<i>Atelornis pittoides</i>
	<i>Mesitornis unicolor</i>	<i>Xenopirostris polleni</i>

A1 ... continued

<i>Oriolia bernieri</i>	<i>Randia pseudozosterops</i>
<i>Euryceros prevostii</i>	<i>Pseudobias wardi</i>
<i>Monticola sharpei</i>	

A2 (094) East Malagasy wet forests EBA: Eight of the 20 species of this EBA have been recorded at this site; see Table 2.

A3 (A15) East Malagasy biome: 26 of the 45 species of this biome have been recorded at this site; see Table 3.

Other threatened/endemic wildlife

Lemurs: *Varecia variegata variegata* (EN), *Indri indri* (EN), *Propithecus diadema diadema* (EN), *Daubentonia madagascariensis* (EN). Carnivore: *Fossa fossana* (VU).

Conservation issues

The main threats are slash-and-burn cultivation (in particular for rice), poaching, collection of palm-hearts, and exploitation for construction wood, including hardwoods such as *Diospyros*, *Ocotea* and *Canthium*.

Further reading

Andriamampianina and Peyrieras (1972), Andriamasy (1991), Jenkins (1987), Nicoll and Langrand (1989), Welch and Katz (1992).

Mangerivola Special Reserve

MG049

Admin region Toamasina

Coordinates 18°11'S 48°54'E

A1, A2 (094), A3 (A15)

Area 11,900 ha Altitude 500–1,500 m

Special Reserve

Site description

The site lies west of Toamasina and south of Fito, with mid-altitude mountainous massifs rising to 1,500 m. Three permanent and fast-flowing rivers run across the reserve—the Sanalaoatra, Marongolo and Ranomena—and include some waterfalls. The forest in the southern and western parts is not easily accessible, as it is on very steep terrain. The vegetation is composed of low- and mid-altitude, dense, humid evergreen forest. Low-altitude forest is characterized by canopy trees of Sarcocaulaceae, Myristicaceae and *Anthostema*, and mid-altitude forest by trees of Burseraceae, Myrtaceae, Monimiaceae, Ebenaceae and Cunoniaceae. Some parts are covered by mosaics of old secondary forest. The watersheds, especially in the northern and north-eastern parts, have been cleared of forest recently, and are (in some places) covered by secondary forest, dominated by *Harungana* and traveller's palm *Ravenala*.

Birds

See Box and Tables 2 and 3 for key species. Seventy-eight species are known from the site, of which 49 are endemic to Madagascar. Two of the species are restricted to the north-eastern forests of Madagascar: *Coua serriana* and *Oriolia bernieri*. Little is known of the site's avifauna.

Key species

A1	<i>Lophotibis cristata</i>	<i>Oriolia bernieri</i>
	<i>Mesitornis unicolor</i>	<i>Monticola sharpei</i>
	<i>Brachypteracias leptosomus</i>	<i>Hartertula flavoviridis</i>
	<i>Atelornis pittoides</i>	<i>Randia pseudozosterops</i>
	<i>Atelornis crossleyi</i>	<i>Pseudobias wardi</i>
	<i>Phyllastrephus cinereiceps</i>	

A2 (094) East Malagasy wet forests EBA: Nine of the 20 species of this EBA have been recorded at this site; see Table 2.

A3 (A15) East Malagasy biome: 26 of the 45 species of this biome have been recorded at this site; see Table 3.

Other threatened/endemic wildlife

Lemurs: *Eulemur rubriventer* (VU), *Varecia variegata variegata* (EN), *Indri indri* (EN). Carnivore: *Fossa fossana* (VU).

Conservation issues

The main threats to the site are bush-fires and slash-and-burn cultivation.

Further reading

ZICOMA (1999).

Didy and Ivondro wetlands

MG050

Admin region Toamasina

Coordinates 18°12'S 48°32'E

A1, A2 (095), A3 (A15), A4i

Area 26,880 ha Altitude 800–1,026 m

Unprotected

Site description

Didy and Ivondro wetlands are located 35 km south-east of Ambatondrazaka, with the villages of Manakambahiny and Sorantelo lying to the north, Ambodinonoka to the south, Didy to the east and Ambohimanjaka to the west. The site is composed of a large natural marsh linked to small lakes and pools, and of the Ivondro river. The marsh vegetation is dominated by sedges (Cyperaceae) and grasses (Gramineae) no more than 1 m high. Its water being acid, the marsh has relatively poor fish-stocks, and fishing is not a significant human activity there. The Ivondro river flows eastwards across the southern part of the site, towards Didy Forest (which lies south-east of the marsh and is a mid-altitude, dense, humid evergreen forest).

Birds

See Box and Tables 2 and 3 for key species. Sixteen species are known from the site, of which four are endemic to Madagascar. *Gallinago macrodactyla* seems particularly common in the marsh. The Ivondro river is one of the few known breeding sites for *Anas melleri*.

Key species

A1	<i>Tachybaptus pelzelinii</i>	<i>Anas melleri</i>
A2 (095)	East Malagasy wetlands EBA: One of the seven species of this EBA have been recorded at this site; see Table 2.	
A3 (A15)	East Malagasy biome: Three of the 45 species of this biome have been recorded at this site; see Table 3.	
A4i	<i>Anas melleri</i>	Breeding (pairs) Breeds
		Non-breeding 45

Conservation issues

Threats to the site and adjacent areas include hunting, exploitation for firewood, slash-and-burn cultivation, and collection of leaves (from marsh vegetation) for basketwork.

Further reading

Pidgeon (1996).

Sihanaka Forest

MG051

Admin region Toamasina

Coordinates 18°25'S 48°45'E

A1, A2 (094), A3 (A15)

Area 423,000 ha Altitude 450–1,300 m Classified Forest, Unprotected

Site description

This vast site is located 48 km north-east of Ambatondrazaka, in the forest corridor between Mantadia and Zahamena National Parks (IBAs MG054 and MG047). Within the site are four Classified Forests: Iofa, Didy, Andriantantely and Sandranantitra. Andriantantely is covered in low-altitude, dense, humid evergreen forest, while the other three are mid-altitude, dense, humid evergreen forest. The terrain is undulating, with mid-altitude mountainous massifs. The main rivers flowing through the site are the Namolazana, Ivondro, Vokovoko, Taheza and Rianila.

Birds

See Box and Tables 2 and 3 for key species. Eighty-two species are known from the site, of which 53 are endemic to Madagascar. This site, especially the forest around Didy and Rogez, was much frequented by the first ornithological explorers of Madagascar, in the 1800s. Recent inventories show that it still holds most of the species previously recorded.

Key species

A1	<i>Tachybaptus pelzelinii</i>	<i>Atelornis pittoides</i>
	<i>Lophotibis cristata</i>	<i>Atelornis crossleyi</i>
	<i>Anas melleri</i>	<i>Oriolia bernieri</i>
	<i>Eutriorchis astur</i>	<i>Monticola sharpei</i>
	<i>Accipiter madagascariensis</i>	<i>Crossleyia xanthophrys</i>
	<i>Accipiter henstii</i>	<i>Randia pseudozosterops</i>
	<i>Brachypteracias leptosomus</i>	<i>Pseudobias wardi</i>
	<i>Brachypteracias squamigera</i>	

A2 (094) East Malagasy wet forests EBA: Nine of the 20 species of this EBA have been recorded at this site; see Table 2.

A3 (A15) East Malagasy biome: 28 of the 45 species of this biome have been recorded at this site; see Table 3.

Other threatened/endemic wildlife

Lemurs: *Indri indri* (EN), *Propithecus diadema diadema* (EN), *Eulemur rubriventer* (VU), *Varecia variegata variegata* (EN), *Daubentonia madagascariensis* (EN). Bat: *Myzopoda aurita* (VU). Carnivores: *Cryptoprocta ferox* (VU), *Fossa fossana* (VU). Reptiles: *Boa manditra* (VU), *B. madagascariensis* (VU). Butterfly: *Papilio mangoura* (VU).

Conservation issues

Threats include slash-and-burn cultivation, illegal exploitation of precious wood, and hunting of lemurs (especially of *Indri indri* in Didy). Sandranantitra is the most affected area.

Further reading

Charbonnier (1998), Jenkins (1987), Salomonsen (1934b), Schmid *et al.* (1999).

North Pangalanes wetlands

MG052

Admin region Toamasina

Coordinates 18°41'S 49°13'E

A1, A3 (A15), A4i

Area 5,500 ha Altitude 10–80 m

Unprotected

Site description

The site is located 65 km south of Toamasina and 30 km north of Ambila-Lemaitso, on the east coast of Madagascar. It comprises the stretch of the Pangalanes Canal between Ambila-Lemaitso and Tampina, as well as lakes (including Lakes Rasoabe, Rasoamasay, Loakangady and Filomo) and scattered forests. The aquatic vegetation in the canal and lakes includes *Cyperus* and (rarely) water-lilies *Nymphaea* and *Najas*. Islets and banks at the water-margins are covered by *Typhonodorum*, *Carex*, *Cyperus*, *Pandanus*, *Fimbristylis*, *Melaleuca* and *Scirpus*. On dry land, there are littoral or low-altitude, dense, humid evergreen forests, as well as plantations of *Casuarina*, *Cocos*, *Eucalyptus*, *Raphia* and *Musa*.

Birds

See Box and Table 3 for key species. Forty-five species are known from the site, of which 13 are endemic to Madagascar. In one recent visit, a few *Anas melleri* and a significant congregation of *Glareola ocularis* were noted.

Key species

A1	<i>Anas melleri</i>		
A3 (A15)	East Malagasy biome: Two of the 45 species of this biome have been recorded at this site; see Table 3.		
A4i	<i>Glareola ocularis</i>	Breeding (pairs) —	Non-breeding 121

Other threatened/endemic wildlife

Lemur: *Daubentonia madagascariensis* (EN).

Conservation issues

Slash-and-burn cultivation, as well as exploitation for construction wood and charcoal, are reducing the extent of forest. This may cause silting-up of the lakes and canal.

Further reading

Pidgeon (1996), Raveloson (1977).

Torotorofotsy wetlands

MG053

Admin region Toamasina

Coordinates 18°52'S 48°21'E

A1, A2 (095), A3 (A15)

Area 5,400 ha Altitude 925–1,038 m

Unprotected

Site description

Torotorofotsy is the largest and most intact natural marsh in eastern

Madagascar. It is located c.7 km north-west of Andasibe, being delimited in the west by the Angavo river and in the east by the Betsimisaraka escarpment. The marsh lies in a basin, elongated along a north-east–south-west axis, and has an indented boundary. It is surrounded by convex hills, with three isolated hillocks in its centre. The Sahaparysy river flows across the marsh. Seventy percent of the site's area is covered by marshy grassland, with permanently waterlogged and peaty soils in the basin, dominated by spike-rushes *Eleocharis* (80 cm to 1 m high), ferns *Osmunda*, sedges *Cyperus* and lianoid sedges *Scleria* (2–3 m high). At the basin overflow and along the western edge there is marshy forest, with abundant screw-pines *Pandanus*, palms *Vonitra* and *Voacanga* trees, while the whole marsh is surrounded by degraded humid evergreen forest (dominated by secondary species such as *Harungana* and *Dichaetanthera*) and wooded savanna. The marsh has poor fish-stocks (the water being relatively acid and nutrient-poor), and fishing is not a significant activity.

■ Birds

See Box and Tables 2 and 3 for key species. Sixty-nine species are known from the site, of which 33 are endemic to Madagascar. Torotorofotsy is one of the two sites currently known for *Sarothrura watersi*, and *Anas melleri* probably breeds at the site.

Key species

A1	<i>Anas melleri</i> <i>Sarothrura watersi</i>	<i>Atelornis pittoides</i>
A2 (095)	East Malagasy wetlands EBA: Five of the seven species of this EBA have been recorded at this site; see Table 2.	
A3 (A15)	East Malagasy biome: 15 of the 45 species of this biome have been recorded at this site; see Table 3.	

■ Conservation issues

Threats to the site and its neighbourhood include exploitation for firewood, slash-and-burn cultivation, and collection of leaves from marsh plants for basketwork. In the past, marsh areas were converted to rice-fields.

■ Further reading

Hawkins (1997), Pidgeon (1996), Rasoavarimanana (1988).

Mantadia National Park and Analamazaotra Special Reserve

MG054

Admin region Toamasina A1, A2 (094, 095), A3 (A15)
Coordinates 18°57'S 48°36'E National Park,
Area 10,685 ha **Altitude** 930–1,185 m Special Reserve

■ Site description

Mantadia National Park is located 5 km north of Andasibe. It is delimited to the west by Andasy Fahatelo and Falierana, and to the south by Ankondromorona forest and Fanovana. Analamazaotra Special Reserve is located 27 km from Moramanga, and is delimited by the Route Nationale 2, the secondary road to Andasibe and the railway line between Antananarivo and Toamasina. Maromizaha State Forest (also part of this site) is located 5 km east of Andasibe, and lies south of the Route Nationale 2. The terrain consists of robust hills and mountain ridges, with many valleys and rivers. Maromizaha Forest is more mountainous than the other two areas. Dense, humid evergreen forest covers the site, with the canopy frequently higher than 25 m at lower altitudes (although forest strata are rather indistinct). There are small marshes in valley floors. The Sahatandra and Amboasary rivers flow through Analamazaotra Special Reserve, and the former also supplies a fish-breeding station. About 50 years ago, the forest was selectively logged for timber.

■ Birds

See Box and Tables 2 and 3 for key species. One hundred and thirteen species are known from the site, of which 68 are endemic to Madagascar, including particularly rare species such as *Tyto soumagnei* and *Eutriorchis astur*. In Maromizaha, montane species that are rare at the two other sites, such as *Atelornis crossleyi*, are also found. *Xenopirostris polleni* occurs in very small numbers. *Anas melleri* is a rare visitor to

wetland areas. *Mesitornis unicolor* may occur in the area, although this still requires confirmation.

Key species

A1	<i>Ardeola idae</i> <i>Lophotibis cristata</i> <i>Eutriorchis astur</i> <i>Accipiter madagascariensis</i> <i>Accipiter henstii</i> <i>Tyto soumagnei</i> <i>Brachypteracias leptosomus</i> <i>Brachypteracias squamigera</i> <i>Atelornis pittoides</i>	<i>Atelornis crossleyi</i> <i>Phyllastrephus cinereiceps</i> <i>Euryceros prevostii</i> <i>Monticola sharpei</i> <i>Hartertula flavoviridis</i> <i>Crossleyia xanthophrys</i> <i>Dromaeocercus brunneus</i> <i>Randia pseudozosterops</i> <i>Pseudobias wardi</i>
A2 (094)	East Malagasy wet forests EBA: 14 of the 20 species of this EBA have been recorded at this site; see Table 2.	
A2 (095)	East Malagasy wetlands EBA: Three of the seven species of this EBA have been recorded at this site; see Table 2.	
A3 (A15)	East Malagasy biome: 35 of the 45 species of this biome have been recorded at this site; see Table 3.	

■ Other threatened/endemic wildlife

Lemurs: *Varecia variegata* (EN), *Indri indri* (EN), *Propithecus diadema diadema* (EN), *Daubentonia madagascariensis* (EN), *Eulemur rubriventer* (VU). Carnivores: *Cryptoprocta ferox* (VU), *Eupleres goudotii* (EN). Amphibian: *Mantella aurantica* (VU). Reptile: *Boa manditra* (VU).

■ Conservation issues

Local practices that threaten the integrity of the site include slash-and-burn cultivation, collection of edible or medicinal products from the forest, and poaching. Analamazaotra or 'Périnet' is one of the more popular tourist sites in Madagascar, due especially to the presence of the lemur *Indri indri*. Many tourists also visit Maromizaha. The railway line from Antananarivo to Toamasina passes nearby. There are graphite mines in the area.

■ Further reading

Andreone (1994), Benson *et al.* (1977), Collar and Stuart (1988), Eguchi *et al.* (1993), Jenkins (1987), Langrand (1989), Nicoll and Langrand (1989), Powzyk (1995a, b), Rasamison (1993), Razafy (1991), Safford and Duckworth (1990), Schmid *et al.* (1999), Siegfried and Froster (1969), Stephenson (1993), Thiollay and Meyburg (1981).

Ankeniheny Classified Forest

MG055

Admin region Toamasina A1, A2 (094), A3 (A15)
Coordinates 19°10'S 48°19'E
Area 26,500 ha **Altitude** 800–1,100 m
 Classified Forest

■ Site description

The site lies 25 km south of Moramanga and has a perimeter of 105 km. The topography shows east–west folding. Several rivers rise in the forest, such as the Ihofika in the east and the Fanjalava and Manampotsy in the west, and many small streams flow through it. Most of the site (14,000 ha) comprises mid-altitude, dense, humid evergreen forest, dominated by trees of *Syzygium*, *Symphonia* and *Canarium*. The remaining area (12,500 ha) is covered by secondary woodland (dominated by *Albizia*), savanna, fallow and cultivated land.

■ Birds

See Box and Tables 2 and 3 for key species. Seventy-four species are known from the site, of which 46 are endemic to Madagascar. *Newtonia fanovanae* is only known elsewhere from a small number of low-altitude sites, and is present here at the upper limit of its altitudinal range.

Key species

A1	<i>Lophotibis cristata</i> <i>Brachypteracias leptosomus</i> <i>Atelornis pittoides</i> <i>Xenopirostris polleni</i> <i>Monticola sharpei</i>	<i>Crossleyia xanthophrys</i> <i>Dromaeocercus brunneus</i> <i>Randia pseudozosterops</i> <i>Newtonia fanovanae</i> <i>Pseudobias wardi</i>
A2 (094)	East Malagasy wet forests EBA: Seven of the 20 species of this EBA have been recorded at this site; see Table 2.	

A3 (A15) East Malagasy biome: 25 of the 45 species of this biome have been recorded at this site; see Table 3.

Other threatened/endemic wildlife

Lemurs: *Indri indri* (EN), *Eulemur rubriventer* (VU), *Varecia variegata variegata* (EN). Carnivore: *Fossa fossana* (VU).

Conservation issues

A significant portion of the forest is subject to community logging, with unknown effects on biodiversity. The forest is managed by local community organizations, which have variable control over illegal logging and hunting by outsiders. Some forest clearance occurs in the area, despite agreements to halt it.

Further reading

Flandez and Andrianarisata (1996), Projet COEFOR/CI SRF-DEF (1993), Ravoavy (1996), Tallec (1996).

Onive Classified Forest

MG056

Admin region Toamasina

Coordinates 19°35'S 47°53'E

A1, A2 (094), A3 (A15)

Area 30,690 ha Altitude 1,300–1,500 m

Classified Forest

Site description

The site is located 18 km south-east of Tsinjoarivo. Its rugged terrain of high, rounded hills is furrowed by narrow valleys. The Onive river flows through the southern part of the site. The mid-altitude, dense, humid evergreen forest has a canopy 10–15 m high, dominated by trees of *Deinbollia*, *Dombeya*, *Ocotea*, *Tambourissa*, *Nuxia* and *Weinmannia*.

Birds

See Box and Tables 2 and 3 for key species. Seventy-one species are known from the site, of which 44 are endemic to Madagascar. The bird community is characteristic of mid-altitude humid forest.

Key species

A1	<i>Accipiter henstii</i>	<i>Monticola sharpei</i>
	<i>Brachypteracias leptosomus</i>	<i>Crossleyia xanthophrys</i>
	<i>Atelornis pittoides</i>	<i>Dromaeocercus brunneus</i>
	<i>Atelornis crossleyi</i>	<i>Randia pseudozosterops</i>
	<i>Phyllastrephus cinereiceps</i>	<i>Pseudobias wardi</i>

A2 (094) East Malagasy wet forests EBA: Eight of the 20 species of this EBA have been recorded at this site; see Table 2.

A3 (A15) East Malagasy biome: 24 of the 45 species of this biome have been recorded at this site; see Table 3.

Other threatened/endemic wildlife

Lemurs: *Eulemur rubriventer* (VU), *Varecia variegata variegata* (EN), *Propithecus diadema diadema* (EN). Carnivores: *Fossa fossana* (VU), *Cryptoprocta ferox* (VU).

Conservation issues

Slash-and-burn cultivation on the hill-slopes is progressing towards the centre of the site and threatens the forest. Other threats include cattle-grazing and the selective felling of trees for construction or for use in fermenting alcoholic beverages. In addition, gold-exploration activities are polluting the Onive river.

Further reading

Delacour (1930), Projet COEFOR/CI SRF-DEF (1993), Rainiberiaka and Tida (1996), Ratsimba Arimino (1998).

Anjozorobe Forest

MG057

Admin region Antananarivo

Coordinates 18°16'S 47°59'E

A1, A2 (094), A3 (A15)

Area 51,490 ha Altitude 900–1,450 m

Unprotected

Site description

The Anjozorobe forest is part of a branch of the eastern rainforest that runs along the Angavo scarp. The forest lies on metamorphic rock,

and the terrain is mountainous and deeply dissected, with steep eroded slopes. The Mananara river, a tributary of the Betsiboka, flows across the western part of the site, which is also crossed by other rivers such as the Sahavila. The main vegetation is mid-altitude, dense, humid evergreen forest. Typical tree genera in the canopy are *Canarium*, *Dilobeia*, *Diospyros*, *Eugenia*, *Protorhus*, *Sloanea*, *Schefflera*, *Tambourissa* and *Weinmannia*. The mid-stratum includes trees/shrubs (*Croton*, *Oncostemum*, *Vernonia*), tree-ferns *Cyathea* and screw-pines *Pandanus*. Palms are relatively rare.

Birds

See Box and Tables 2 and 3 for key species. Eighty species are known from the site, of which 50 are endemic to Madagascar. Most of the species that are restricted to humid forest can be found.

Key species

A1	<i>Lophotibis cristata</i>	<i>Phyllastrephus cinereiceps</i>
	<i>Mesitornis unicolor</i>	<i>Monticola sharpei</i>
	<i>Brachypteracias leptosomus</i>	<i>Crossleyia xanthophrys</i>
	<i>Atelornis pittoides</i>	<i>Dromaeocercus brunneus</i>
	<i>Atelornis crossleyi</i>	<i>Randia pseudozosterops</i>
	<i>Neodrepanis hypoxantha</i>	<i>Pseudobias wardi</i>

A2 (094) East Malagasy wet forests EBA: 10 of the 20 species of this EBA have been recorded at this site; see Table 2.

A3 (A15) East Malagasy biome: 28 of the 45 species of this biome have been recorded at this site; see Table 3.

Other threatened/endemic wildlife

Lemurs: *Eulemur rubriventer* (VU), *Propithecus diadema diadema* (EN).

Conservation issues

Threats include illegal clearing, fires, collection of non-timber forest products (medicinal plants, honey), fishing (fish and crayfish) and hunting.

Further reading

Rakotondravony and Goodman (1998), Ramanitra (1995b).

Lake Itasy

MG058

Admin region Antananarivo

Coordinates 19°04'S 46°47'E

A1, A2 (095), A3 (A15)

Area 3,500 ha Altitude 1,221 m

Unprotected

Site description

Lake Itasy is located 10 km south-east of Analavory and 25 km north-west of Soavinandriana. It is a freshwater crater-lake with marshy areas in its southern and eastern parts, lying within a steep-sloped volcanic massif. It is permanent, with seasonal variations in the water-level, having an average depth of 4 m but reaching up to 10 m at its centre. The Andranomena and Mariandrano rivers feed the lake in the east, while the Lily river flows out of the lake. The lake receives a lot of sediment from the rivers and from the eroded adjacent slopes. There is marginal vegetation of reedbeds *Phragmites* and clumps of *Cyperus* (up to 2 m), and floating mats of the non-native water-hyacinth *Eichhornia*. Submerged plants include *Ceratophyllum* and *Potamogeton*. Near the middle of the lake, there is dense vegetation of various very tall aquatic plants.

Birds

See Box and Tables 2 and 3 for key species. Forty-four species are known from the lake, of which 10 are endemic to Madagascar. The dense vegetation near the middle of the lake is a refuge for herons (Ardeidae) and rails (Rallidae). A locally resident population of *Anas melleri* is probably of national importance. *Ardea humbloti* is infrequently recorded.

Key species

A1	<i>Tachybaptus pelzelni</i>	<i>Anas melleri</i>
	<i>Ardeola idae</i>	<i>Circus maillardi</i>

A2 (095) East Malagasy wetlands EBA: Two of the seven species of this EBA have been recorded at this site; see Table 2.

A3 (A15) East Malagasy biome: Three of the 45 species of this biome have been recorded at this site; see Table 3.

Conservation issues

The escarpments around the lake are completely bare of vegetation as a result of bush-fires and agriculture, and the significant erosion that ensues is accelerating the silting-up of the lake.

Further reading

Battistini and Donque (1962), Payne (1960).

Wetlands of the Tsiribihina delta and upper Tsiribihina river

MG059

Admin region Toliara

Coordinates 19°45'S 44°26'E

A1, A2 (096), A3 (A14), A4i

Area 264,100 ha Altitude 0–200 m

Unprotected

Site description

The site is located 35 km west of Belo-sur-Tsiribihina. The Tsiribihina delta includes the shoreline, sandbanks, lagoons, coastal mudflats, mangrove forest, saltflats, and areas of marsh and of dry land. The mangrove is 2–4 m high, and dominated by trees of *Avicennia*, *Rhizophora*, *Ceriops*, *Bruguiera* and *Sonneratia*. The saltflats often flood during the rainy season. The marshy areas are dominated by sedge *Cyperus*, reed *Phragmites* and non-native water-hyacinth *Eichhornia*, while the dry land is covered in savanna, with palms. The wetlands of the upper Tsiribihina river include the neighbouring lakes, and the Sahajilo and Mania rivers. Lake Kimanomby, west of Ambohibary village, is surrounded by dense, dry deciduous forest (Ambovondambo Forest to the west, Marotapia Forest to the east). There is no floating vegetation, but the margins are covered by *Eichhornia*. Lake Masoarivo, west of Masoarivo village, is small, shallow and red due to muddy sediments. Lake Hima has floating vegetation and is surrounded by fishermen's camps. In the Tsiribihina valley, between the towns of Miandrivazo and Malaimbandy, there are several lakes and a vast area of marshes, dominated by sedge *Cyperus* and reed *Phragmites*.

Birds

See Box and Tables 2 and 3 for key species. Eighty-two species have been recorded, of which 22 are endemic to Madagascar. There are a few pairs of *Haliaeetus vociferoides*, including at least one in the upper valley of the Tsiribihina, and *Anas bernieri* breed in the mangroves. There are large congregations of *Glareola ocularis* on the banks of the Tsiribihina, and one of the most significant congregations of *Thalassornis leucotis insularis* in Madagascar can be found in Masoarivo.

Key species

A1	<i>Ardea humbloti</i>	<i>Haliaeetus vociferoides</i>
	<i>Ardeola idae</i>	<i>Charadrius thoracicus</i>
	<i>Anas bernieri</i>	
A2 (096)	West Malagasy wetlands EBA: Four of the six species of this EBA have been recorded at this site; see Table 2.	
A3 (A14)	West Malagasy biome: Eight of the 24 species of this biome have been recorded at this site; see Table 3.	
A4i	Breeding (pairs)	Non-breeding
	<i>Ardea humbloti</i>	— 50
	<i>Anas bernieri</i>	Breeds 40
	<i>Charadrius thoracicus</i>	— 46
	<i>Tringa cinerea</i>	— 642
	<i>Glareola ocularis</i>	— 250
	<i>Sterna bengalensis</i>	— 3,300

Other threatened/endemic wildlife

Lemurs: *Propithecus verreauxi deckeni* (VU), *P. verreauxi coronatus* (CR). Reptile: *Boa madagascariensis* (VU).

Conservation issues

Human activities in the mangroves include exploitation for construction wood and firewood, and collection of nestling waterbirds for food. Close to the mouth of the Ambakivao river, hunting is frequent near the areas that support large congregations of *Phoenicopterus ruber*. In the upper Tsiribihina, there is also significant pressure resulting from hunting and conversion of marshes to rice-fields.

Further reading

Safford (1993).

Menabe Forest complex

MG060

Admin region Toliara

Coordinates 20°02'S 44°39'E

A1, A2 (093, 096), A3 (A14)

Area 112,000 ha

Special Reserve, Classified Forest,

Altitude 1–100 m

Private Reserve, Unprotected

Site description

The site lies on the Menabe coastal plain, between the Andranomena and Tsiribihina rivers, 30 km north of Morondava. It includes Amborompotsy (Kirindy) Forest, Andranomena Special Reserve, Analabe Private Reserve and Ampataka Classified Forest. It is delimited in the west by mangroves, and, in the east, by the Bongolava plateau. Several seasonal watercourses cross the forest, flowing during the wet season. There are also small seasonal lakes, mostly in the southern part of the site. Amborompotsy is a dense, dry deciduous forest, 12–15 m high on average, and dominated by trees of *Adansonia* (up to 20 m), *Commiphora*, *Securinega*, *Poupartia*, *Baudouinia*, *Dalbergia* and *Cedrelopsis*. The ground layer (1–5 m high) is very dense, with most woody species being evergreen. Andranomena Forest, 15 km south-west of Amborompotsy, is similar in structure and plant-species composition, with, however, a more pronounced abundance of certain taxa, e.g. *Euphorbia* and *Givotia*.

Birds

See Box and Tables 2 and 3 for key species. Large numbers of waterbirds occur in the area. It is one of the six sites known for *Mesitornis variegata*.

Key species

A1	<i>Tachybaptus pelzelii</i>	<i>Accipiter madagascariensis</i>
	<i>Ardeola idae</i>	<i>Accipiter henstii</i>
	<i>Lophotibis cristata</i>	<i>Mesitornis variegata</i>
	<i>Phoenicopterus minor</i>	<i>Philepitta schlegeli</i>
A2 (093)	West Malagasy dry forests EBA: Three of the six species of this EBA have been recorded at this site; see Table 2.	
A2 (096)	West Malagasy wetlands EBA: One of the six species of this EBA has been recorded at this site; see Table 2.	
A3 (A14)	West Malagasy biome: Seven of the 24 species of this biome have been recorded at this site; see Table 3.	

Other threatened/endemic wildlife

Lemurs: *Mirza coquereli* (VU), *Phaner furcifer pallescens* (VU), *Propithecus verreauxi verreauxi* (VU). Carnivores: *Mungotictis decemlineata decemlineata* (VU), *Cryptoprocta ferox* (VU). Rodent: *Hypogeomys antimena* (EN). Reptiles: *Pyxis planicauda* (EN), *Furcifer labordi* (VU), *Boa dumerili* (VU).

Conservation issues

Amborompotsy Forest is managed as an ecotourist site by the Forestry Training Centre (Centre de Formation Professionnelle Forestière). A project is working in the area to promote sustainable management of forest resources. Human activities that disturb the forest include illegal exploitation of wood, slash-and-burn cultivation, and hunting (especially of nocturnal lemurs).

Further reading

Appert (1985, 1996), Bloxam *et al.* (1993), Cabalzar (1993), Durrell *et al.* (1989), Ganzhorn and Sorg (1996), Hawkins (1993b, 1994c, d, 1995c, 1996), Hawkins and Wilmé (1996), Hladik (1980), Nicoll and Langrand (1989), Ramanitra *et al.* (1993), Sauvegarde et Aménagement des Forêts–Côte Ouest [SAF-CO] (1992), Steinbacher (1972), Walter (1979), Werding (1972).

Kirindy-South Forest complex

MG061

Admin region Toliara

Coordinates 21°10'S 44°00'E

A2 (096, 097), A3 (A14)

Area 70,000 ha Altitude 0–30 m

National Park

Site description

This site consists of two forests, Kirindy-South Forest and Mite Forest, which are located respectively close to, and 17 km from, Marofihitse. The forests are situated in the Menabe region, a coastal

plain of mainly sandy soils. The Kirindy river flows across the south of Kirindy Forest, while the Lampaolo river runs through Mite Forest. The dense, dry deciduous forest is dominated by trees of *Adansonia*, *Cedrelopsis*, *Commiphora*, *Givotia*, *Delonix*, *Baudouinia*, *Dalbergia*, *Strychnos* and *Tamarindus*. Bushes of *Didierea* and *Euphorbia* occur near the coast. There are also vast saltflats on the coast.

■ Birds

See Box and Tables 2 and 3 for key species. Several bird species characteristic of dry forest occur, as do several characteristic of spiny forest. Good numbers of *Phoenicopterus ruber* and *Anas bernieri* occur seasonally on the coastal saltflats.

Key species

A1	<i>Lophotibis cristata</i> <i>Anas bernieri</i>	<i>Accipiter madagascariensis</i> <i>Accipiter henstii</i>
A2 (096)	West Malagasy wetlands EBA: One of the six species of this EBA has been recorded at this site; see Table 2.	
A2 (097)	South Malagasy spiny forests EBA: Three of the 10 species of this EBA have been recorded at this site; see Table 2.	
A3 (A14)	West Malagasy biome: Nine of the 24 species of this biome have been recorded at this site; see Table 3.	

■ Other threatened/endemic wildlife

Lemurs: *Lemur catta* (VU), *Propithecus verreauxi verreauxi* (VU). Carnivore: *Mungotictis decemlineata* (VU; probably *M. d. lineata*).

■ Conservation issues

Kirindy-South is a National Park of 72,200 ha, of which under half is forested. Threats include clearance of forest for agriculture (notably in the east of the national park and peripheral areas of Mite Forest), poaching of birds, and illegal exploitation of wood (especially *Givotia*) for the construction of traditional pirogues.

■ Further reading

Appert (1996), Commission Nationale Malgache pour l'UNESCO (1998), Hawkins (1994, 1996), Hawkins *et al.* (1993), Langrand (1987), ORGASYS (1996), Werding (1972).

Lake Ihotry Hunting Reserve–Mangoky Delta complex

MG062

Admin region Toliara

 Coordinates 21°38'S 43°39'E A1, A2 (096), A3 (A14), A4i
 Area 139,520 ha Altitude 6–50 m Hunting Reserve, Unprotected

■ Site description

This complex is located 30 km north-east of Morombe, and comprises Lake Ihotry, the Mangoky river and delta, and associated riverine marshes near the Ankiliabo–Nosy Ambositra road. The lake is brackish and c.3 m deep. Its area varies seasonally, from 960 ha up to 11,200 ha, and it is only sparsely vegetated, with some reed *Phragmites*, sedge *Cyperus* and water-lily *Nymphaea*. Mangrove, dominated by *Rhizophora* and *Avicennia*, occurs all along the delta coast, from Mangolovolo to Andranopasy. The marsh vegetation consists mainly of *Cyperus*, reed-mace *Typha*, *Typhonodorum*, *Phragmites* and *Nymphaea*. Near the wetlands, on sandy soil, there is dry deciduous forest, dominated by Didiereaceae and Euphorbiaceae, as well as sub-arid spiny bushland, and savanna with occasional trees of *Tamarindus* and *Zizyphus*.

■ Birds

See Box and Tables 2 and 3 for key species. One hundred and six species are known from this site, of which 23 are endemic to Madagascar. *Amauornis olivieri* was found in the marsh of Nosy Ambositra in 1960, but has not been recorded since then. Lake Ihotry is an exceptional site for foraging and roosting waterbirds, notably during the northern winter. During the dry season, muddy areas attract large numbers of waders, and the site is also a dry-season refuge for waterbirds that use the seasonal wetlands between Morombe and Toliara. Significant numbers of *Phoenicopterus ruber* and *Tachybaptus ruficollis* have been observed, and also large

numbers of other birds, such as *Anas erythrorhyncha* and *Tringa nebularia*.

Key species

A1	<i>Tachybaptus pelzelinii</i> <i>Ardea humbloti</i> <i>Ardeola idae</i> <i>Lophotibis cristata</i> <i>Phoenicopterus minor</i>	<i>Haliaeetus vociferoides</i> <i>Circus maillardi</i> <i>Amauornis olivieri</i> <i>Charadrius thoracicus</i>
A2 (096)	West Malagasy wetlands EBA: Five of the six species of this EBA have been recorded at this site; see Table 2.	
A3 (A14)	West Malagasy biome: Five of the 24 species of this biome have been recorded at this site; see Table 3.	
A4i	Breeding (pairs)	Non-breeding
	<i>Tachybaptus ruficollis</i>	— 620
	<i>Ardea humbloti</i>	— 50
	<i>Anas bernieri</i>	— 40
	<i>Charadrius thoracicus</i>	— 46
	<i>Tringa cinerea</i>	— 642
	<i>Glareola ocularis</i>	— 250
	<i>Sterna bengalensis</i>	— 3,300

■ Other threatened/endemic wildlife

Lemurs: *Lemur catta* (VU), *Propithecus verreauxi verreauxi* (VU). Carnivore: *Cryptoprocta ferox* (VU).

■ Conservation issues

Poaching, uncontrolled burning of grassland for pasture, and clearance for agriculture are severe threats. The latter two processes put the wetlands at risk of silting up. Mangrove trees are exploited for their bark (for tannin) and timber.

■ Further reading

Appert (1966, 1968a, 1970, 1972), Griveaud (1960), Jenkins (1987), Rand (1936), Salomonsen (1934a), World Wide Fund for Nature–Madagascar (1997).

Mangoky–Ankazoabo Forest

MG063

Admin region Toliara

 Coordinates 21°54'S 44°07'E A2 (097), A3 (A14)
 Area 98,000 ha Altitude 200–560 m Unprotected

■ Site description

The site is centred on the lower Mangoky river, 30 km south of Manja. Hills and mountains alternate with more or less flat areas. The main rivers in the area are the Mangoky, Sakanavaka and Sakavoay. The vegetation is composed of dense, dry deciduous forest, degraded in parts, and the most common trees are baobabs *Adansonia*. Areas of savanna also occur, sometimes with scattered trees of *Sclerocarya*, *Stereospermum*, *Celastrus*, *Tamarindus*, and palms *Bismarckia*.

■ Birds

See Box and Tables 2 and 3 for key species. Sixty-one species are known from the site, of which 40 are endemic to Madagascar. Ankazoabo Forest holds of the species that are characteristic of spiny forest. A species of *Monticola* found in the Mangoky canyons is not certainly identified but could be *Monticola bensoni*. Species of global conservation concern include *Tachybaptus pelzelinii*, *Ardeola idae*, *Lophotibis cristata*, *Accipiter madagascariensis* and *Accipiter henstii*.

Key species

A2 (097)	South Malagasy spiny forests EBA: Four of the 10 species of this EBA have been recorded at this site; see Table 2.	
A3 (A14)	West Malagasy biome: Nine of the 24 species of this biome have been recorded at this site; see Table 3.	

■ Conservation issues

Bush-fires are the only threat noted.

■ Further reading

Appert (1966, 1968a, 1970, 1972).

Mikea Forest

Admin region Toliara

Coordinates 22°18'S 43°28'E

Area 394,300 ha Altitude 10–200 m

MG064

A1, A2 (096, 097), A3 (A14)

Unprotected

Site description

This site is located on an undulating littoral plain, west of the Morombe–Toliara road. It is delimited in the east by the foothills of the Mikoboka-South calcareous plateau. The soil is sandy, with dunes in some areas. Lake Andranobe is semi-permanent. The native vegetation of xerophilous bushland (up to 12 m high) is dominated by *Didierea*, *Euphorbia*, *Aloe*, *Adansonia*, *Albizia*, *Tamarindus* and *Givotia*. The bushland in the northern area is very degraded near Lake Ihotry and is bisected by a belt of savanna in the west. Towards the coast, the vegetation is lower and bushier, and, in the central area, there is dry deciduous forest, similar in structure to the forest north of Mangoky.

Birds

See Box and Tables 2 and 3 for key species. Ninety-eight species are known from the site, of which 40 are endemic to Madagascar. *Monias benschi* and *Uratelornis chimaera* do not occur in any other IBAs. *Monias benschi* is found mainly in the densest bushland, and *Uratelornis chimaera* in the most open bushland.

Key species

A1	<i>Tachybaptus pelzelinii</i>	<i>Monias benschi</i>
	<i>Lophotibis cristata</i>	<i>Uratelornis chimaera</i>
	<i>Accipiter madagascariensis</i>	
A2 (096)	West Malagasy wetlands EBA: One of the six species of this EBA has been recorded at this site; see Table 2.	
A2 (097)	South Malagasy spiny forests EBA: Eight of the 10 species of this EBA have been recorded at this site; see Table 2.	
A3 (A14)	West Malagasy biome: 12 of the 24 species of this biome have been recorded at this site; see Table 3.	

Other threatened/endemic wildlife

Lemurs: *Lemur catta* (VU), *Propithecus verreauxi verreauxi* (VU). Reptiles: *Geochelone radiata* (VU), *Pyxis arachnoides* (VU), *Phelsuma standingi* (VU), *Boa dumerili* (VU).

Conservation issues

Human activities are threatening the site—the exploitation of wood for charcoal production and construction is causing significant damage to the bushland and forest. Cattle-grazing (in particular near the lake), slash-and-burn cultivation (especially in the central area) and bush-fires also have a negative impact on the vegetation.

Further reading

Appert (1966, 1968a, b, c, 1970, 1972, 1985), Domergue (1986), Hartert (1912), Lavauden and Poisson (1929), Nicoll and Langrand (1989), Salmon (1984), Turner (1981), Rand (1936), Seddon (2001).

Zombitse-Vohibasia National Park

Admin region Toliara

Coordinates 22°37'S 44°49'E

Area 74,000 ha Altitude 485–825 m

MG065

A1, A2 (093), A3 (A14)

National Park

Site description

This site lies c.10 km from Sakaraha and 130 km from Toliara, and consists of the Zombitse, Vohibasia and Isoky-Vohimena Forests, which cover a gently undulating terrain of dome-shaped sandstone hills. The Isalo massif lies to the east, and a calcareous plateau (820 m high) to the west—both are oriented north–south. The soil is sandy. The Fiherenana and Teheza rivers, tributaries of the Onilahy, rise within the Zombitse and Vohibasia Forests. The vegetation consists of dense deciduous forest and xerophilous bushland, dominated by *Securinega*, *Malleastrum*, *Carissa* and *Teclea*, with some emergents, such as *Commiphora* and *Brachylaena*. The xerophilous bushland is characterized by species of *Euphorbia*, *Adansonia* and *Dialium*.

Birds

See Box and Tables 2 and 3 for key species. Ninety species are known from this site, of which 38 are endemic to Madagascar. One of the endemic species, *Phyllastrephus apperti*, is known only from the forests of Zombitse and Analavelona (IBA MG066). Two species, *Thamnornis chloropetoides* and *Nesillas lantzii*, are characteristic of spiny forest. *Monticola bensoni* is recorded here seasonally.

Key species

A1	<i>Tachybaptus pelzelinii</i>	<i>Accipiter madagascariensis</i>
	<i>Ardeola idae</i>	<i>Accipiter henstii</i>
	<i>Lophotibis cristata</i>	<i>Phyllastrephus apperti</i>
	<i>Circus maillardi</i>	<i>Monticola bensoni</i>
A2 (093)	West Malagasy dry forests EBA: Three of the six species of this EBA have been recorded at this site; see Table 2.	
A3 (A14)	West Malagasy biome: Eight of the 24 species of this biome have been recorded at this site; see Table 3.	

Other threatened/endemic wildlife

Lemurs: *Mirza coquereli* (VU), *Phaner furcifer pallescens* (VU), *Lemur catta* (VU), *Propithecus verreauxi verreauxi* (VU). Carnivore: *Cryptoprocta ferox* (VU). Bats: *Scotophilus robustus* (nt), *Mormopterus jugularis* (VU). Reptile: *Phelsuma standingi* (VU).

Conservation issues

The park is a biological reservoir of primary importance, due to its location straddling the western and southern domains of Madagascar. Route Nationale 7 runs through Zombitse Forest. The main threats include exploitation of forest species, cattle-grazing, vegetation clearance and deforestation for maize cultivation or production of charcoal, as well as uncontrolled bush-fires.

Further reading

Benson (1974), Bru (1996), Collar and Stuart (1988), Colston (1972), Goodman and Langrand (1994), Jenkins (1987), Langrand and Goodman (1997), Mustoe (1997), Mustoe *et al.* (1998), Nicoll and Langrand (1989), Randriantavy (1993), Razafimahaimodison (1993).

Analavelona Forest

Admin region Toliara

Coordinates 22°39'S 44°10'E

Area 9,675 ha Altitude 900–1,321 m

MG066

A1, A2 (093), A3 (A14)

Unprotected

Site description

Analavelona Forest is located west-north-west of Sakaraha. It lies on a vast peneplain oriented north–south, with indented flanks, steep slopes and steep-sided valleys. Springs in the forest feed rivers such as the Fiherenana, which flows in the south-east. Variations in soil composition, altitude and topography have engendered a diverse vegetation, with well-stratified, dense, humid evergreen forest in the lowlands (rich in lianas), dense sclerophyllous montane forest (with an open understorey) on the slopes, plateau and some peaks, and xerophilous bushland on rocky outcrops. The forest is characterized by the presence of tall trees, such as *Uapaca* and *Dalbergia*. Strangler-figs are abundant, and *Dracaena* and *Aloe* also occur. Grassland covers the open areas and sides of the massif.

Birds

See Box and Tables 2 and 3 for key species. Sixty-one species are known from this site, of which 29 are endemic to Madagascar. The humid nature of the forest explains the presence of three species characteristic of the East Malagasy biome: *Neomixis viridis*, *Foudia omissa* and *Phyllastrephus zosterops*. The abundance of *Phyllastrephus apperti* is also interesting: this species is only found elsewhere in the Zombitse complex (IBA MG065), 50 km to the south-east.

Key species

A1	<i>Accipiter henstii</i>	<i>Monticola bensoni</i>
	<i>Phyllastrephus apperti</i>	
A2 (093)	West Malagasy dry forests EBA: Three of the six species of this EBA have been recorded at this site; see Table 2.	
A3 (A14)	West Malagasy biome: Three of the 24 species of this biome have been recorded at this site; see Table 3.	

Other threatened/endemic wildlife

Lemur: *Propithecus verreauxi verreauxi* (VU). Carnivore: *Cryptoprocta ferox* (VU).

Conservation issues

Neighbouring people use the forest for livestock-grazing, collection of honey, collection of medicinal plants, and poaching (notably of lemurs). These activities are mitigated somewhat by the difficulty of access and the presence of cattle-thieves.

Further reading

Griveaud and Peyrieras (1972).

Saint Augustin Forest

Admin region Toliara

Coordinates 23°34'S 43°48'E

Area 100,000 ha Altitude 0–100 m

MG067

A1, A2 (097), A3 (A14)

Unprotected

Site description

This site is located on the northern bank of the Onilahy river, about 20 km south of Toliara. It is bordered in the west by rocky banks and humid sands and has a rugged micro-relief. A tributary of the Onilahy rises within the forest. The vegetation is composed of xerophilous bushland, dominated by Euphorbiaceae, with an open canopy (up to 4–5 m high).

Birds

See Box and Tables 2 and 3 for key species. *Calicalicus rufocarpalis*, a recently described species, is known only from this site and from the Mahafaly Plateau Forest complex (IBA MG070).

Key species

A1 *Coua verreauxi*

A2 (097) South Malagasy spiny forests EBA: Five of the 10 species of this EBA have been recorded at this site; see Table 2.

A3 (A14) West Malagasy biome: Nine of the 24 species of this biome have been recorded at this site; see Table 3.

Conservation issues

Most of the bushland is intact, except along the road-edge, where it was significantly exploited in the past, especially for charcoal production. The risk of habitat destruction is currently low since the local population is composed of fishermen.

Further reading

Goodman *et al.* (1997), Hawkins *et al.* (1998).

Beza Mahafaly Special Reserve

Admin region Toliara

Coordinates 23°41'S 44°35'E

Area 600 ha Altitude 100–200 m

MG068

A2 (097), A3 (A14)

Special Reserve

Site description

This site is located 17 km from Betioky, on the Mahafaly plateau, and is divided into two parcels, covering 80 ha (Parcel 1) and 520 ha (Parcel 2) respectively. It lies in a large valley, with flat lowlands and gentle slopes. The soil is generally sandy. The Sakamena river, a seasonal tributary of the Onilahy, flows along the boundary of the reserve. The vegetation comprises riparian forest and xerophilous bushland. Riparian forest, found mainly in Parcel 1, is dominated by trees of *Tamarindus*, *Acacia*, *Quivisianthe* and *Albizia* in the upper layer, by small trees and shrubs of *Crateva*, *Azima*, *Antidesma* and *Euphorbia* in the mid-stratum, and by *Tarenna*, *Byttneria* and *Greslania* in the ground layer. Xerophilous bushland, found mainly in Parcel 2, is dominated by *Alluaudia*, *Cedrelopsis* and *Grewia* in the upper layer, and by *Commiphora*, *Euphorbia*, *Gyrocarpus*, *Pachypodium* and *Aloe* in the lower layer.

Birds

See Box and Tables 2 and 3 for key species. Sixty-one species are known from this site, of which 27 are endemic to Madagascar. Species of global conservation concern include *Accipiter madagascariensis*.

Key species

A2 (097) South Malagasy spiny forests EBA: Four of the 10 species of this EBA have been recorded at this site; see Table 2.

A3 (A14) West Malagasy biome: Eight of the 24 species of this biome have been recorded at this site; see Table 3.

Other threatened/endemic wildlife

Lemurs: *Eulemur catta* (VU), *Propithecus verreauxi verreauxi* (VU). Carnivore: *Cryptoprocta ferox* (VU). Reptile: *Boa dumerili* (VU).

Conservation issues

Threats to the site include cattle-grazing, traditional hunting of birds, and hunting of tortoises for consumption.

Further reading

Goodman *et al.* (1992), Langrand (1996), Nicoll and Langrand (1989), Rakotonomenjanahary (1996).

Tsimanampetsotse Strict Nature Reserve

Admin region Toliara

Coordinates 24°07'S 43°48'E

Area 43,000 ha Altitude 38–114 m

MG069

A1, A2 (096, 097), A3 (A14), A4i

Strict Nature Reserve,

Ramsar Site

Site description

This site lies on the Mahafaly karst plateau, 180 km south-west of Betioky-South and 75 km south of Toliara. It consists of a lake and a bushland area on a sandy plain, 20 km long and 3 km wide on average, c.7 km inland of the Mozambique Channel, and a large area of stunted spiny forest on the calcareous plateau inland. Lake Tsimanampetsotse is shallow and has a milky colour, being the only soda-saturated lake in Madagascar. A cliff, c.100 m high, rises 1–2 km from the eastern bank of the lake. Swallow-holes on the plateau hold small lakes, from which small freshwater streams issue after rainfall. Near Lake Tsimanampetsotse, in some areas, the water is more brackish. Torrents of less brackish water flow through underground caves. Trees between the lake and the cliff can be up to 12 m high, but the vegetation of the western part of the site, between the lake and the sea, is lower, being covered in xerophilous bushland (up to 2.2 m high), and characterized by species of *Cassia*, *Ficus*, *Pluchea*, *Erythroxylum*, *Cedrelopsis*, *Delonix*, *Acacia*, *Albizia*, *Maytenus*, *Euphorbia* and *Berchemia*. Some *Casuarina* have been planted on the eastern bank of the lake.

Birds

See Box and Tables 2 and 3 for key species. Eighty-eight species are known from this site, of which 35 are endemic to Madagascar. Tsimanampetsotse and Baly Bay are the only protected areas that hold *Charadrius thoracicus*. *Anas bernieri* has been recorded once at the lake.

Key species

A1 *Phoenicopterus minor*

Accipiter madagascariensis

A2 (096) West Malagasy wetlands EBA: One of the six species of this EBA has been recorded at this site; see Table 2.

A2 (097) South Malagasy spiny forests EBA: Seven of the 10 species of this EBA have been recorded at this site; see Table 2.

A3 (A14) West Malagasy biome: 12 of the 24 species of this biome have been recorded at this site; see Table 3.

A4i

Charadrius thoracicus

Charadrius thoracicus

Coua verreauxi

Breeding (pairs)

Non-breeding

—

55

Other threatened/endemic wildlife

Lemurs: *Lemur catta* (VU), *Propithecus verreauxi verreauxi* (VU). Carnivore: *Galidictis grandidieri* (EN; only found in this reserve). Reptiles: *Pyxis arachnoides* (VU), *Geochelone radiata* (VU). Fish: *Typhleotris madagascariensis* (VU; a blind fish of underground caves).

Conservation issues

The reserve is still generally intact and undegraded, except for the pastureland in the western part of the site. Hunting of birds and tortoises, as well as the collection of honey, are threats to the site. Local taboos prohibit access to some areas which are considered sacred.

Further reading

Andriamampianina and Peyrieras (1972), Jenkins (1987), Langrand (1995), Milon (1948b), Nicoll and Langrand (1989), Petit (1935), Rand (1936), Salomonsen (1934a), World Wide Fund for Nature–Madagascar (1997), Wozenkraft (1986).

Mahafaly Plateau Forest complex

MG070

Admin region Toliara

Coordinates 24°32'S 44°03'E

A1, A2 (097), A3 (A14)

Area 17,800 ha Altitude 40–258 m

Unprotected

Site description

This site includes the Hatokaliotse and Linta Forests, located 140 km south of Toliara and 77 km west of Ejeda. A plateau of eroded karst, it is delimited to the west by a north–south–running escarpment, with cliffs and steep slopes. There are no permanent rivers, but freshwater sources occur in the swallow-holes that are scattered across the plateau. Linta Forest comprises two forest blocks, Antsihanaka and Sambatio. The vegetation is composed of xerophilous bushland (2–5 m high, with emergents up to 10 m high), dominated by *Didierea*, *Alluaudia* and *Euphorbia*, with a very dense understorey, often difficult to access. *Cedrelopsis* trees are found mainly in the forest along the bottom of the cliff, and there are also plantations of non-native prickly-pear cactus *Opuntia*. The eastern and north-eastern areas of the Antsihanaka Forest are less rich in Didiereaceae and the canopy is no higher than 2 m.

Birds

See Box and Tables 2 and 3 for key species. Fifty-eight species are known from this complex, of which 31 are endemic to Madagascar. The site is the southern limit known for the distribution of *Calliclicus rufocarpalis*, a species described in 1997.

Key species

 A1 *Accipiter madagascariensis*
Coua verreauxi

A2 (097) South Malagasy spiny forests EBA: Eight of the 10 species of this EBA have been recorded at this site; see Table 2.

A3 (A14) West Malagasy biome: 12 of the 24 species of this biome have been recorded at this site; see Table 3.

Other threatened/endemic wildlife

Lemur: *Lemur catta* (VU). Reptiles: *Geochelone radiata* (VU), *Pyxis arachnoides* (VU).

Conservation issues

This is the driest area in Madagascar and the density of the human population is quite low. The bushland is a seasonal refuge and pasture area for cattle, especially during dry periods. Threats to the forest include cutting of wood for construction, and conversion to cultivation, of maize in particular.

Further reading

Hawkins *et al.* (1998).

Andohahela National Park—Parcel I

MG071

Admin region Toliara

Coordinates 24°42'S 46°44'E

A1, A2 (094), A3 (A15)

Area 63,100 ha Altitude 90–1,972 m

National Park

Site description

Parcel I of Andohahela National Park is located 84 km north-east of Tolagnaro. It includes a portion of the mountainous massif of Beampingaratra, oriented north–south, and five peaks above 1,500 m. The main river rising in the parcel is the Mandrare, augmented by the waters from its two tributaries, the Mananara and the Manambolo. In the east, the Manampanihy and Andriambe rivers flow respectively towards the north-east and the south-east. The vegetation is composed of low- and mid-altitude, dense, humid evergreen forest, dominated by trees of *Tambourissa*, *Symphonia* and *Dalbergia*, although the steep slopes are dominated by Lauraceae, Compositae, Rubiaceae and Convolvulaceae. Tree-ferns and orchids are common, and epiphytic cacti *Rhipsalis* also occur.

Birds

See Box and Tables 2 and 3 for key species. Eighty-seven species are known from the site, of which 57 are endemic to Madagascar. The site is the southern limit of the distribution of several species, in particular those which are characteristic of montane forest. The site holds four species of ground-roller (Brachypteraciidae), two species of *Neodrepanis*, *Randia pseudozosterops*, *Cryptosylvicola randrianasoloi*, nine species of vanga (Vangidae) and *Newtonia fanovanae*.

Key species

 A1 *Lophotibis cristata*
Xenopirostris polleni
Accipiter henstii
Monticola sharpei
Brachypteracias leptosomus
Hartertula flavoviridis
Brachypteracias squamigera
Crossleyia xanthophrys
Atelornis pittoides
Dromaeocercus brunneus
Atelornis crossleyi
Randia pseudozosterops
Neodrepanis hypoxantha
Newtonia fanovanae
Phyllastrephus cinereiceps
Pseudobias wardi

A2 (094) East Malagasy wet forests EBA: 13 of the 20 species of this EBA have been recorded at this site; see Table 2.

A3 (A15) East Malagasy biome: 31 of the 45 species of this biome have been recorded at this site; see Table 3.

Other threatened/endemic wildlife

Lemurs: *Eulemur fulvus collaris* (VU), *Propithecus verreauxi verreauxi* (VU). Carnivores: *Cryptoprocta ferox* (VU), *Fossa fossana* (VU), *Galidictis fasciata* (VU), *Eupleres goudotii* (EN).

Conservation issues

Threats include slash-and-burn cultivation, burning of pastures, exploitation of wood, and hunting, especially of lemurs.

Further reading

Andriamampianina and Peyrieras (1972), Goodman *et al.* (1997), Griveaud and Peyrieras (1972), Hawkins and Goodman (1999), Jenkins (1987), Milon (1948a), Nicoll and Langrand (1989), Schulenberg *et al.* (1993).

Tsitongambarika Classified Forest

MG072

Admin region Toliara

Coordinates 24°42'S 47°00'E

A1, A2 (094), A3 (A15)

Area 76,200 ha

Classified Forest,

Altitude 100–1,358 m

Unprotected

Site description

This site is located 9 km north of Tolagnaro, and includes Manantantely Forest (to the south of the Classified Forest) and the forest located between Bemangidy and Enanafia (to the north). The site is part of the Tsitongambarika massif, which is composed of a series of ridges that are aligned from north-east to south-west. The Manampanihy river flows northwards along the western boundary of the site. The vegetation is composed of low- and mid-altitude, dense, humid evergreen forest and sclerophyllous montane forest. At low altitudes, it is dominated by trees of *Sorindeia*, *Ilex*, *Tambourissa*, *Oncostemum*, *Syzygium* and *Dracaena*, with a canopy 15–25 m high. At mid-altitudes, trees of *Macaranga* and *Oncostemon*, as well as species of Moraceae, Myrtaceae, Guttiferae and Monimiaceae, are dominant, with a canopy 12–20 m high.

Birds

See Box and Tables 2 and 3 for key species. Thirty-seven species are known from this site, of which 22 are endemic to Madagascar. The population of *Mesitornis unicolor* seems to be quite dense in some lowland areas. The taxon *Hypositta perdita* was described on the basis of a specimen from this area, and it is possible that it can still be found there, if the taxon is valid. *Coua gigas*, a species characteristic of the West Malagasy biome, is also found at this site.

Key species

 A1 *Mesitornis unicolor*
Brachypteracias squamigera

A2 (094) East Malagasy wet forests EBA: Three of the 20 species of this EBA have been recorded at this site; see Table 2.

A3 (A15) East Malagasy biome: Nine of the 45 species of this biome have been recorded at this site; see Table 3.

Other threatened/endemic wildlife

Lemur: *Eulemur fulvus collaris* (VU).

Conservation issues

A portion of the north-eastern area, called Farafara Forest (31.4 ha), is dedicated to sustainable selective exploitation. The main threat is slash-and-burn cultivation, which affects at least 25% of the site, especially along the forest margins. Other threats include hunting, and soil erosion caused by cultivation on steep slopes.

Further reading

Goodman *et al.* (1997), Hagen (1991), Milon (1948), Projet CAF/APN (1998), Projet COEFOR/CI SRF-DEF (1993), Rand (1951).

Andohahela National Park—Parcel II MG073

Admin region Toliara

Coordinates 24°53'S 46°34'E

Area 12,420 ha Altitude 120–1,006 m

A2 (097), A3 (A14)

National Park

Site description

Parcel II of Andohahela National Park is located 52 km from Ambovombe, south of the Mananara river. It extends over a calcareous plateau, with a series of undulating hills that peak at 1,006 m (Vohidagoro). On the plateau, the vegetation is composed of xerophilous bushland of Didiereaceae, Euphorbiaceae, Leguminosae and Crassulaceae. Higher areas are dominated by dwarf *Aloe*, with *Pachypodium* on the highest areas.

Birds

See Box and Tables 2 and 3 for key species. Eighty-three species are known from this site, of which 31 are endemic to Madagascar. Although Parcels I and II are only separated by a few kilometres, their bird faunas are quite different. Andohahela is the only protected area in Madagascar which contains a contact area between two biogeographical regions: humid forest (confined to Parcel I) and spiny forest (Parcel II). Interesting endemic species include *Falco zoniventris*, four species of *Coua*, *Newtonia archboldi* and six species of vanga (Vangidae). Species of global conservation concern include *Ardeola idae*.

Key species

A2 (097) South Malagasy spiny forests EBA: Four of the 10 species of this EBA have been recorded at this site; see Table 2.

A3 (A14) West Malagasy biome: Eight of the 24 species of this biome have been recorded at this site; see Table 3.

Other threatened/endemic wildlife

Plant: *Alluaudia ascendens* is endemic to the Mandrare region. Lemurs: *Lemur catta* (VU), *Propithecus verreauxi verreauxi* (VU), *Phaner furcifer* (probably *P. f. pallascens*) (VU). Carnivore: *Cryptoprocta ferox* (VU).

Conservation issues

Pressures on the site include hunting, exploitation of wood, and cattle-grazing.

Further reading

Goodman *et al.* (1997), Griveaud and Peyrieras (1972), Hawkins and Goodman (1999), Jenkins (1987), Nicoll and Langrand (1989), Schulenberg *et al.* (1993).

South-western coastal wetlands MG074

Admin region Toliara

Coordinates 25°05'S 44°10'E

Area 29,580 ha Altitude 0–10 m

A1, A2 (096), A3 (A14), A4i

Unprotected

Site description

These coastal wetlands are located 50 km south-west of Ampanihy. The site includes Nosy Manitse, located 10 km off Bevoalavo, as well as a large strip of forest (35–40 km long and 130–200 m wide) between Bevoalavo West and Bezavo, Anataiky Bay, Cape Fenambosy and Androkahele Bay. The wetlands are composed of reddish-brown

sandbanks extending along the coast. Androkahele Bay comprises a vast sandy area covered by muddy sediments from the River Linta. The wetlands of Cape Fenambosy and Anataiky Bay are brackish. The interior of Anataiky Bay is bordered by a muddy area, partly covered by savanna and partly by mangrove.

Birds

See Box and Tables 2 and 3 for key species. Thirty-eight species are known from this site, of which four are endemic to Madagascar. There are many *Sterna bengalensis* and *Sterna bergii*. In the 1940s, a colony of more than 4,000 pairs of *Sterna dougallii* was present on Nosy Manitse. The current status of this colony is not known. *Threskiornis (aethiopicus) bernieri* occurs, at the southern limit of its range, as does a significant population of *Charadrius thoracicus*.

Key species

A1	<i>Ardea humbloti</i>	<i>Charadrius thoracicus</i>
A2 (096)	West Malagasy wetlands EBA: Two of the six species of this EBA have been recorded at this site; see Table 2.	
A3 (A14)	West Malagasy biome: Two of the 24 species of this biome have been recorded at this site; see Table 3.	
A4i		Breeding (pairs) Non-breeding
	<i>Charadrius thoracicus</i>	— 25
	<i>Sterna bengalensis</i>	— 1,300
	<i>Sterna bergii</i>	— 800
	<i>Sterna dougallii</i>	— 9,000

Conservation issues

Hunting of birds and collection of eggs, especially on Nosy Manitse, are the main threats. The colony of *Sterna dougallii* may no longer be present, due to the presence of fishermen's camps on the islands.

Further reading

Battistini (1958), Commission Nationale Malgache pour l'UNESCO (1998), Milon (1948c).

Menarandra Forest MG075

Admin region Toliara

Coordinates 25°06'S 44°34'E

Area 114,700 ha Altitude 120–200 m

A2 (097), A3 (A14)

Unprotected

Site description

This forest is part of the Karimbola plateau, and lies on the banks of the Menarandra river, 40 km south of Ampanihy. The hilly terrain is bordered by an alluvial (clay) plain and old sand-dunes. The vegetation of xerophilous bushland is dominated by Didiereaceae (notably *Alluaudia*) and Euphorbiaceae, with a canopy no higher than 6 m. There are isolated trees (the remnants of a degraded riparian forest), as well as alluvial vegetation, mainly composed of *Tamarindus*, *Ficus*, *Cedrelopsis* and *Flacourtia*. The bushland is, in some places, replaced by grassland with some woody species, including *Commiphora*, *Phyllanthus*, *Harpagophytum*, *Adansonia* (in the middle of *Alluaudia* thickets), and *Euphorbia*.

Birds

See Box and Tables 2 and 3 for key species. There is a particular abundance of species characteristic of *Euphorbia* bushland, such as *Coua verreauxi* and *Monticola imerinus*. Species of global conservation concern include *Circus maillardi* and *Coua verreauxi*.

Key species

A2 (097) South Malagasy spiny forests EBA: Six of the 10 species of this EBA have been recorded at this site; see Table 2.

A3 (A14) West Malagasy biome: Seven of the 24 species of this biome have been recorded at this site; see Table 3.

Other threatened/endemic wildlife

Lemur: *Propithecus verreauxi verreauxi* (VU). Reptiles: *Geochelone radiata* (VU), *Pyxis arachnoides* (VU).

Conservation issues

In the Menarandra Forest, only a few areas, termed 'alafaly', have not been cleared, due to the presence of funeral monuments.

Exploitation for firewood and cattle-grazing have negative impacts on the site.

Further reading

Battistini (1958).

Lakes Anony and Erombo

MG076

Admin region Toliara

Coordinates 25°09'S 46°39'E

A1, A2 (096), A3 (A14), A4i

Area 4,100 ha Altitude 0–100 m

Unprotected

Site description

The two lakes are located on the southern coast of Madagascar, in the lower Mandrare valley, c.75 km from Tolagnaro. Lake Anony is brackish and tidal, being linked to the sea by a channel. Lake Erombo is shallow and dries up outside the rainy season. The surrounding vegetation is xerophilous bushland, which is dense on the northern and eastern banks of Lake Anony, with a canopy 4.5 m high dominated by *Didierea* and *Alluaudia*. In the west, between Anivorano and Antsavelo villages, the bush lies on old dunes, dominated by succulent bushes *Euphorbia*. Some baobabs *Adansonia* and *Salvadora* scrub also occur, and there is a vast industrial plantation of sisal *Agave* near the lake.

Birds

See Box and Tables 2 and 3 for key species. During the rainy season, Lake Erombo holds large numbers of waterbirds. Clumps of *Euphorbia* are the favourite habitat of *Monticola imerinus*. This is the only site in the region that is known to hold *Tachybaptus pelzelni*. The bushland is a foraging area for forest birds. Many migratory Palearctic species have been recorded at the site.

Key species

A1	<i>Tachybaptus pelzelni</i>	<i>Phoenicopterus minor</i>
	<i>Ardea humbloti</i>	
A2 (096)	West Malagasy wetlands EBA: One of the six species of this EBA has been recorded at this site; see Table 2.	
A3 (A14)	West Malagasy biome: Three of the 24 species of this biome have been recorded at this site; see Table 3.	
A4i	<i>Phoenicopterus ruber</i>	Breeding (pairs) — Non-breeding 3,000

Conservation issues

Commercial fishing and hunting take place in the lower Mandrare valley. *Phoenicopterus ruber* is among the preferred quarry.

Further reading

Goodman *et al.* (1997), Nicoll and Langrand (1989).

Cape Sainte Marie Special Reserve

MG077

Admin region Toliara

Coordinates 25°34'S 45°09'E

A1, A2 (097), A3 (A14)

Area 1,750 ha Altitude 110–199 m

Special Reserve

Site description

This site, also called Cape Vohimena, is located 60 km south-west of Tsihombe. It is the southernmost headland in Madagascar, lying on a calcareous plateau. Soils are sandy. Steep cliffs delimit the southern and western boundaries of the site. There are no permanent watercourses in the area, only small, temporary streams that flow to the sea following rare heavy rain. Wind-stunted xerophilous bushland (up to 1.2 m) covers c.90% of the site. The most common woody species are *Commiphora* and *Salvadora*, with local species of *Aloe* and *Megistostegium* also present.

Birds

See Box and Tables 2 and 3 for key species. Thirty-six species are known from this site, of which 18 are endemic to Madagascar. There is a large population of *Coua verreauxi* at the site.

Key species

A1	<i>Coua verreauxi</i>
----	-----------------------

A2 (097) South Malagasy spiny forests EBA: Three of the 10 species of this EBA have been recorded at this site; see Table 2.

A3 (A14) West Malagasy biome: Six of the 24 species of this biome have been recorded at this site; see Table 3.

Other threatened/endemic wildlife

Reptile: *Geochelone radiata* (VU); a very large population occurs in the reserve.

Conservation issues

Various pressures threaten the site. A lighthouse was erected within the reserve in 1971, and the employees and their families live nearby. They have cleared some 5 ha of the bushland for food cultivation. Intensive goat-grazing also occurs. Several tons of leaves, seeds and roots are collected each year for sale in traditional medicine. In 1985, workers from Tolagnaro, who were building new facilities around the lighthouse, consumed tortoises *Geochelone radiata* found in the area.

Further reading

Hawkins (1995e), Nicoll and Langrand (1989).

Zafimaniry Forest

MG078

Admin region Fianarantsoa

Coordinates 20°43'S 47°27'E

A2 (094), A3 (A15)

Area 16,000 ha Altitude 1,000–1,200 m

Unprotected

Site description

This site is located south-east of Ambositra, on the eastern escarpment, and generally consists of a very undulating plateau, descending towards the east. Two tributaries of the Mananjary river flow through the forest—the Maintinandry and the Ambinanindrano. These are fast-flowing, permanent rivers with waterfalls, which can be as high as 60 m. The mid-altitude, dense, humid evergreen forest is dominated by *Dalbergia*, *Weinmannia* and *Symphonia*.

Birds

See Box and Tables 2 and 3 for key species. Fifty-six species are known from the site, of which 35 are endemic to Madagascar. The bird community is typical of humid forest. Species of global conservation concern include *Lophotibis cristata*, *Atelornis pittoides*, *Phyllastrephus cinereiceps*, *Crossleyia xanthophrys*, *Dromaeocercus brunneus* and *Pseudobias wardi*.

Key species

A2 (094) East Malagasy wet forests EBA: Three of the 20 species of this EBA have been recorded at this site; see Table 2.

A3 (A15) East Malagasy biome: 18 of the 45 species of this biome have been recorded at this site; see Table 3.

Other threatened/endemic wildlife

Lemurs: *Eulemur rubriventer* (VU), *Propithecus diadema edwardsi* (EN).

Conservation issues

Threats include slash-and-burn cultivation, exploitation for wood, grazing, and collection of wild honey.

Further reading

Razafimahaleo (1980), Siegfried and Froster (1969).

Ranomafana National Park

MG079

Admin region Fianarantsoa

Coordinates 21°16'S 47°28'E

A1, A2 (094, 095), A3 (A15)

Area 41,713 ha Altitude 400–1,374 m

National Park

Site description

Ranomafana National Park is located 45 km north-east of Fianarantsoa. The forested terrain comprises a succession of hills and summits, separated by narrow valleys and lowlands. The Namorona river flows across the park. Three types of forest are present: the

low- and mid-altitude, dense, humid evergreen forest and the sclerophyllous montane forest. Marshes have formed on the sites of former rice-fields; the IBA includes c.100 ha of marsh outside the park.

■ Birds

See Box and Tables 2 and 3 for key species. One hundred and thirteen species are known from the area of the site, of which 64 are endemic to Madagascar. The majority of species of mid- and high altitudes are present. Some lowland species known from elsewhere are absent; it is unclear if others occur within or just outside the park. *Xenopirostris polleni* and *Mesitornis unicolor*, scarce and patchy elsewhere in Madagascar, seem to be reasonably common. Several marshland species, including *Sarothrura watersi* and *Anas melleri*, occur just outside the National Park, and this area is included within the IBA.

Key species

A1	<i>Lophotibis cristata</i>	<i>Brachypteracias squamigera</i>
	<i>Anas melleri</i>	<i>Atelornis pittoides</i>
	<i>Circus maillardi</i>	<i>Atelornis crossleyi</i>
	<i>Accipiter madagascariensis</i>	<i>Neodrepanis hypoxantha</i>
	<i>Accipiter henstii</i>	<i>Phyllastrephus cinereiceps</i>
	<i>Mesitornis unicolor</i>	<i>Dromaeocercus brunneus</i>
	<i>Sarothrura watersi</i>	<i>Randia pseudozosterops</i>
A2 (094)	East Malagasy wet forests EBA: 12 of the 20 species of this EBA have been recorded at this site; see Table 2.	
A2 (095)	East Malagasy wetlands EBA: Five of the seven species of this EBA have been recorded at this site; see Table 2.	
A3 (A15)	East Malagasy biome: 34 of the 45 species of this biome have been recorded at this site; see Table 3.	

■ Other threatened/endemic wildlife

Lemurs: *Eulemur rubriventer* (VU), *Hapalemur aureus* (CR), *H. simus* (CR), *Varecia variegata variegata* (EN), *Propithecus diadema edwardsi* (EN), *Daubentonia madagascariensis* (EN). Carnivores: *Cryptoprocta ferox* (VU), *Fossa fossana* (VU), *Galidictis fasciata* (VU).

■ Conservation issues

Threats include itinerant slash-and-burn cultivation around the park, and cattle-grazing within the park.

■ Further reading

Andreone (1994), Jenkins (1987), Nicoll and Langrand (1989), Prum and Razafindratsita (1997), Rakotomanana (1998), Rakotomanana and Hino (1998), Razafimahaimodison and Andrianantenina (1993), Wilmé and Langrand (1990), Zack (1994).

Andringitra National Park

Admin region Fianarantsoa

Coordinates 22°14'S 46°54'E A1, A2 (094, 095), A3 (A15)

Area 31,160 ha Altitude 700–2,650 m National Park

MG080

■ Site description

Andringitra National Park is located 35 km south of Ambalavao. This mountainous, high-altitude massif comprises a series of rocky domes and a chain of outcrops with narrow crests which form numerous pinnacles, divided by deep, narrow valleys and gorges. The climate is hot and humid in the eastern low-altitude part, and temperate and humid in the higher western part. A highly developed hydrographic system drains the massif: the main rivers are the Zomandao, Menarahaka, Iatara and Rienana. Park vegetation includes low-altitude, dense, humid evergreen forest (with *Sloanea* as an emergent), mid-altitude, dense, humid evergreen forest (characterized by trees of *Podocarpus*, *Weinmannia*, screw-pines *Pandanus*, tree-ferns *Cyathea*, as well as Compositae in the higher part, and *Vaccinium* in the lower parts), and dense sclerophyllous montane forest characterized by trees of *Podocarpus*, Araliaceae, Compositae, Erythroxylaceae and Verbenaceae. On the bare, open rock of the summits, the vegetation includes species of *Philippia*, *Aloe*, *Pachypodium*, Liliaceae and *Kalanchoe*, with a high level of local endemism. There are some areas of savanna around the two highest summits, Pic Boby and Pic Bory, which are rich in terrestrial orchids, including *Cynorkis*, *Habenaria* and *Disa*.

■ Birds

See Box and Tables 2 and 3 for key species. One hundred and twelve species are known from the site, of which 65 are endemic to Madagascar. The forest species present are largely those of middle and higher altitudes; several lowland species are missing. A population of rock thrushes *Monticola* in the summit zone is possibly referable to *M. bensoni*. *Ploceus sakalava*, a species characteristic of the West Malagasy biome, occurs on the western slopes of the massif.

Key species

A1	<i>Tachybaptus pelzelii</i>	<i>Atelornis crossleyi</i>
	<i>Lophotibis cristata</i>	<i>Neodrepanis hypoxantha</i>
	<i>Anas melleri</i>	<i>Phyllastrephus cinereiceps</i>
	<i>Circus maillardi</i>	<i>Xenopirostris polleni</i>
	<i>Accipiter madagascariensis</i>	<i>Monticola sharpei</i>
	<i>Accipiter henstii</i>	<i>Hartertula flavoviridis</i>
	<i>Mesitornis unicolor</i>	<i>Crossleyia xanthophrys</i>
	<i>Brachypteracias leptosomus</i>	<i>Dromaeocercus brunneus</i>
	<i>Brachypteracias squamigera</i>	<i>Randia pseudozosterops</i>
	<i>Atelornis pittoides</i>	
A2 (094)	East Malagasy wet forests EBA: 10 of the 20 species of this EBA have been recorded at this site; see Table 2.	
A2 (095)	East Malagasy wetlands EBA: Two of the seven species of this EBA have been recorded at this site; see Table 2.	
A3 (A15)	East Malagasy biome: 33 of the 45 species of this biome have been recorded at this site; see Table 3.	

■ Other threatened/endemic wildlife

Lemurs: *Eulemur fulvus albocollaris* (EN), *E. rubriventer* (VU), *Hapalemur aureus* (CR), *H. simus* (CR), *Lemur catta* (VU), *Varecia variegata variegata* (VU), *Propithecus diadema edwardsi* (EN), *Daubentonia madagascariensis* (EN). Carnivores: *Cryptoprocta ferox* (VU), *Fossa fossana* (VU).

■ Conservation issues

Threats include itinerant slash-and-burn cultivation (particularly of forest at low altitudes), cattle-grazing, uncontrolled bush-fires and hunting.

■ Further reading

Andriamampianina and Peyrieras (1972), Goodman (1997), Jenkins (1987), Langrand and Goodman (1995), (1996), Nicoll and Langrand (1989).

Isalo National Park

Admin region Fianarantsoa

Coordinates 22°23'S 45°15'E A1, A2 (093), A3 (A14)

Area 81,540 ha Altitude 510–1,268 m National Park

MG081

■ Site description

This site is 180 km long and 20–25 km wide, and is located 3 km from Ranohira. It consists of a large sandstone massif, with a peculiar ruinlike aspect, that rises out of a plain. This chain of outcrops includes deeply eroded canyons, the most famous of which are Monkey Canyon and Rat Canyon. The hydrographic network is composed of clear, fast-flowing streams, which drain into the tributaries of the Menamaty in the east, and into those of the Mangoky and Malio in the west. There are also marshes, such as at Andranovorinkaolo, as well as lakes, such as the Golden Lake, whose flora includes *Polygonum*, *Echinochloa*, *Panicum* and *Cyperus*. Forest covers 10% of the park's area, and comprises three types. The dense, dry deciduous forest, mainly composed of *Commiphora* and *Dalbergia*, is relatively degraded. Gallery forest is dominated by *Eugenia*, *Tamarindus* and *Mangifera*—one area of this type, Andranofotsy, in the north of the park, has an area of c.240 ha. Low- and mid-altitude, dense, humid evergreen forest occurs in the shelter of canyons and is composed of *Voacanga*, *Nuxia*, *Weinmannia* and *Tambourissa*. The understorey is composed of thick clumps of ferns *Blechnum*. The vegetation on open areas of bare rock includes species of *Pachypodium*, *Kalanchoe*, *Senecio*, *Aloe*, *Helichrysum* and *Euphorbia*. Wooded savanna covers 40% of the site's area, and includes trees of *Stereospermum*, *Albizia*, *Borassus*, *Pemphis* and *Dicoma*. Open savanna, with or without scattered palms (of *Bismarckia* and *Hyphaene*) is more common.

Birds

See Box and Tables 2 and 3 for key species. Eighty-one species are known from the site, of which 27 are endemic to Madagascar. The range of *Monticola bensoni* is restricted to the Isalo–Zombitse Vohibasia region, including Analavelona (IBA MG066) and possibly the Mangoky canyons (MG063). It appears to have a rather patchy distribution within the park, being absent from large areas in the centre.

Key species

A1	<i>Tachybaptus pelzelii</i>	<i>Circus maillardi</i>
	<i>Ardeola idae</i>	<i>Accipiter henstii</i>
	<i>Lophotibis cristata</i>	<i>Monticola bensoni</i>
A2 (093)	West Malagasy dry forests EBA: One of the six species of this EBA has been recorded at this site; see Table 2.	
A3 (A14)	West Malagasy biome: One of the 24 species of this biome has been recorded at this site; see Table 3.	

Other threatened/endemic wildlife

Lemurs: *Mirza coquereli* (VU), *Propithecus verreauxi verreauxi* (VU), *Lemur catta* (VU).

Conservation issues

Uncontrolled bush-fires are the main threat, but others include illegal exploitation for firewood and construction wood, and poaching. Sapphire mining is likely to become a problem in the near future.

Further reading

Andriamampianina and Peyrieras (1972), Farkas (1971), Hawkins and Raharimalala (1995), Jenkins (1987), Langrand and Goodman (1996), Nicoll and Langrand (1989).

Vondrozo Classified Forest

MG082

Admin region Fianarantsoa

Coordinates 22°47'S 47°10'E A1, A2 (094, 095), A3 (A15)

Area 29,850 ha Altitude 570–650 m Classified Forest

Site description

Vondrozo Classified Forest is located about 5 km west of Vondrozo. The forest is part of the still-continuous corridor between Andringitra (IBA MG080) and Midongy-South (MG084), and is generally of lowland forest. The terrain is fairly flat and uniform with some low hills. The site is drained by small, permanent tributaries of the Manapatrana river in the north and by tributaries of the Mananara in the south. The low-altitude, dense, humid evergreen forest is nearly intact, with a canopy 15–20 m high, dominated by species of *Dalbergia*, *Ocotea*, *Weinmannia*, *Uapaca*, *Canarium*, *Eugenia* and *Diospyros*. The understorey is not dense and allows easy access to the forest interior, except near the marshes.

Birds

See Box and Tables 2 and 3 for key species. Eighty-five species are known from the site, of which 50 are endemic to Madagascar. Rand (1936) mentions a record of *Oriolia bernieri* from a site in south-eastern Madagascar with this name; it is not clear if this is the site intended.

Key species

A1	<i>Lophotibis cristata</i>	<i>Brachypteracias squamigera</i>
	<i>Anas melleri</i>	<i>Atelornis pittoides</i>
	<i>Circus maillardi</i>	<i>Monticola sharpei</i>
	<i>Accipiter henstii</i>	<i>Newtonia fanovanae</i>
	<i>Brachypteracias leptosomus</i>	
A2 (094)	East Malagasy wet forests EBA: Five of the 20 species of this EBA have been recorded at this site; see Table 2.	
A2 (095)	East Malagasy wetlands EBA: Two of the seven species of this EBA have been recorded at this site; see Table 2.	
A3 (A15)	East Malagasy biome: 22 of the 45 species of this biome have been recorded at this site; see Table 3.	

Other threatened/endemic wildlife

Lemur: *Propithecus diadema edwardsi* (EN). Reptile: *Boa manditra* (VU).

Conservation issues

Bird-hunting and the collection of wild honey pose relatively minor threats. Forest to the north and south of the site is under pressure for cultivation.

Further reading

Delacour and Berlioz (1931), Projet COEFOR/CI SRF-DEF (1993), Rand (1936), Randrianasolo (1996), Salomonsen (1934b).

Kalambatritra Special Reserve

MG083

Admin region Fianarantsoa

Coordinates 23°24'S 46°29'E A1, A2 (094), A3 (A15)

Area 28,250 ha Altitude 850–1,600 m Special Reserve

Site description

Kalambatritra is located 40 km east of Betroka. The terrain of undulating hills and steep summits is part of the Antaivondro-Kalambatritra mountain chain. Many clear and permanent tributaries of the Mangoky and the Ionaivo have their sources in the reserve. The low- and mid-altitude, dense, humid evergreen forest is little disturbed, and has a canopy 15–25 m high with emergents reaching 30 m. Characteristic trees include figs *Ficus*, *Dalbergia* and tree-ferns *Cyathea*. The humus layer is 10–25cm thick. Savannas of coarse grass (*Aristida*, *Imperata*) divide the forest into blocks, and a strip of bracken *Pteridium* borders the forest. The border of the protected area includes large areas of savanna.

Birds

See Box and Tables 2 and 3 for key species. Seventy-four species are known from the site, of which 45 are endemic to Madagascar. The species found are characteristic of humid forest, despite the site being located at the edge of the Eastern forest area.

Key species

A1	<i>Anas melleri</i>	<i>Monticola sharpei</i>
	<i>Circus maillardi</i>	<i>Hartertula flavoviridis</i>
	<i>Atelornis pittoides</i>	<i>Crossleyia xanthophrys</i>
	<i>Atelornis crossleyi</i>	<i>Dromaeocercus brunneus</i>
	<i>Phyllastrephus cinereiceps</i>	<i>Randia pseudozosterops</i>
	<i>Xenopirostris polleni</i>	<i>Pseudobias wardi</i>
A2 (094)	East Malagasy wet forests EBA: Nine of the 20 species of this EBA have been recorded at this site; see Table 2.	
A3 (A15)	East Malagasy biome: 23 of the 45 species of this biome have been recorded at this site; see Table 3.	

Other threatened/endemic wildlife

Lemurs: *Eulemur fulvus collaris* (VU), *E. rubriventer* (VU).

Conservation issues

Grazing of livestock is the only human activity known to constitute a threat.

Further reading

Nicoll and Langrand (1989).

Midongy-South National Park

MG084

Admin region Fianarantsoa

Coordinates 23°33'S 46°57'E A1, A2 (094), A3 (A15)

Area 67,568 ha Altitude 689–1,357 m National Park

Site description

This site is located about 94 km south-east of Vangaindrano, and consists of two parts: the Soarano Forest (24,145 ha) and the Befotaka Forest (43,423 ha). The terrain is mountainous and steep-sloped. Many streams drain these slopes to feed marshes in the lowlands, which cover c.10% of the site (and small pools 5%). The mid-altitude, dense, humid evergreen forest typically holds trees of *Diospyros*, *Dalbergia*, *Brachylaena*, *Cryptocarya*, *Ravensara*, *Eugenia*, *Tambourissa*, *Ocotea*, *Uapaca*, *Calophyllum*, *Elaeocarpus* and *Symphonia*. Marsh vegetation includes screw-pine *Pandanus* and sedge *Carex*.

Birds

See Box and Tables 2 and 3 for key species. Ninety-three species are known from the site, of which 52 are endemic to Madagascar. *Anas melleri* has been observed in the area, but it is not known if it breeds locally.

Key species

A1	<i>Lophotibis cristata</i>	<i>Phyllastrephus cinereiceps</i>
	<i>Mesitornis unicolor</i>	<i>Xenopirostris polleni</i>
	<i>Brachypteracias leptosomus</i>	<i>Monticola sharpei</i>
	<i>Brachypteracias squamigera</i>	<i>Crossleyia xanthophrys</i>
	<i>Atelornis pittoides</i>	<i>Randia pseudozosterops</i>
	<i>Atelornis crossleyi</i>	<i>Pseudobias wardi</i>

A2 (094) East Malagasy wet forests EBA: Nine of the 20 species of this EBA have been recorded at this site; see Table 2.

A3 (A15) East Malagasy biome: 28 of the 45 species of this biome have been recorded at this site; see Table 3.

Other threatened/endemic wildlife

Lemurs: *Eulemur fulvus collaris* (VU), *Propithecus diadema edwardsi* (EN), *Daubentonia madagascariensis* (EN).

Conservation issues

Slash-and-burn cultivation is the main threat, but others include the collection of various forest products, forest clearance, hunting, cattle-grazing, and cyclone damage.

Further reading

Nicoll and Langrand (1989), ORGASYS (1998).

BIBLIOGRAPHY

- ALBIGNAC, R. (1970) Mammifères et oiseaux du massif Tsaratanana. *Mémoires ORSTOM* 37: 223–229.
- ANDREONE, F. (1994) *Conservation aspects of the herpetofauna of Malagasy rainforest*. Italy: Zoological Society “La Torbiera” (Scientific reports No. 1).
- ANDRIAMAMPANINA, J. AND PEYRIERAS, A. (1972) Les Réserves Naturelles Intégrales de Madagascar. In *Compte-rendu de la Conférence Internationale sur la conservation de la nature et de ses ressources à Madagascar, 7–11 octobre 1970*. Gland, Switzerland: IUCN.
- ANDRIAMASY, M. H. (1991) Rapport d’enquête socio-économique et évaluation des activités du SAF, RNI de Betampona.
- ANDRIANARIMISA, A. (1992) La Sarcelle de Bernier, *Anas bernieri*, un canard endémique à protéger. *Working Group on Birds in the Madagascar Region Newsletter* 2(1): 6–7.
- ANDRIANARIMISA, A. (1993) Variation structurale de la communauté avienne d’une forêt dense semi-caducifoliée dans l’Ouest malgache. *Proceedings of the 8th Pan-African Ornithological Congress, Bujumbura, Burundi*.
- ANGAP/ORGASYS (1998) Etude et mise en place d’une structure opérationnelle au niveau de Tsaratanana / Manongarivo. Rapport préliminaire. Liste des espèces faunistiques recensées dans la RNI de Tsaratanana (Annexe I). Antananarivo, Madagascar: ANGAP.
- ANGAP/UNEP/ONE (1998) Monographie nationale sur la biodiversité. ANGAP, Antananarivo, Madagascar.
- APPERT, O. (1966) La répartition géographique des Couas dans la région du Mangoky. *Bulletin de l’Académie Malgache* 44: 29–42.
- APPERT, O. (1968a) La répartition géographique des vangidés dans la région du Mangoky et la question de leur présence aux différentes époques de l’année. *L’Oiseau et Revue Française d’Ornithologie* 38: 6–19.
- APPERT, O. (1968b) Beobachtungen an *Monias benschi* in Südwest-Madagaskar. *J. Orn.* 109: 402–417.
- APPERT, O. (1968c) Zur Brutbiologie der Erdracke *Uratelornis chimaera* Rothschild. *J. Orn.* 109: 264–275.
- APPERT, O. (1970) Zur Biologie der Vangawurger (Vangidae) südwest-Madagaskars. *Ornithologische Beobachter* 67: 101–133.
- APPERT, O. (1972) Relation entre biotope et endémisme chez les oiseaux de la région du Mangoky, Sud-Ouest de Madagascar. In *Compte-rendu de la Conférence Internationale sur la conservation de la nature et de ses ressources à Madagascar*. Gland, Switzerland: IUCN.
- APPERT, O. (1985) Zur Biologie der Mesitornithiformes (Nakas oder “Stelzenrallen”) Madagaskars und erste fotografische Dokumente von Vertretern der Ordnung. *Ornithologische Beobachter* 82: 31–54.
- APPERT, O. (1996) The avifauna in the region of Morondava. *Working Group on Birds in the Madagascar Region Newsletter* 6(1): 19–54.
- AURIVILLIUS, M. AND AURIVILLIUS, H. (1994) Masoala, Madagascar. Unpubl. field report. Copy available at ZICOMA Project.
- BATTISTINI, R. (1958) Structure géomorphologique du littoral Karimbola. *Mémoires de l’Institut Scientifique de Madagascar, Série F, Tome II*.
- BATTISTINI, R. (1959) Description géomorphologique de Nosy Be, du Delta de Sambirano et de la Baie d’Amipasindava. *Mémoires de l’Institut Scientifique de Madagascar, Série F, Tome IV*: 127–134.
- BATTISTINI, R. AND DONQUE, G. (1962) L’excursion dans le massif volcanique de l’Itasy, Madagascar. *Revue de la Géographie* 2: 58–82. [Université d’Antananarivo, Madagascar].
- BENSON, C. W. (1974) Une race nouvelle du Martin chasseur malgache. *L’Oiseau et Revue Française d’Ornithologie* 44: 186–187.
- BENSON, C. W., COLEBROOK-ROBJENT, J. F. R. AND WILLIAMS, A. (1977) Contribution à l’ornithologie de Madagascar. *L’Oiseau et Revue Française d’Ornithologie* 46: 103–134; 47: 41–61, 167–191.
- BERKELMAN, J. (1997a) Food habits of the Madagascar buzzard in the rain forest of the Masoala peninsula. *Condor* 99: 833–835.
- BERKELMAN, J. (1997b) Information Sheet on Ramsar Wetlands (Lac Mandrozo). Unpubl. report to Peregrine Fund Madagascar.
- BIODEV MADAGASCAR (1998) Inventaire ornithologique dans la région de Daraina, Rapport Préliminaire. Antananarivo, Madagascar: Association FANAMBY.
- BLOXAM, Q. M. C., BEHLER, J. L., RAKOTOVAO, E. R. AND RANDRIAMHAZO, H. (1993) Distribution of the Madagascar Flat-tailed tortoise. *Dodo* 29: 149–155.
- BOUSQUET, B. AND RABETALIANA, H. (1992) *Site du patrimoine mondial du Tsingy de Bemaraha et autres sites d’intérêt biologique et écologique du Fivondronana d’Antsalova*. Paris: UNESCO.
- BRU, E. (1996) Transformation des milieux et vie avienne à Madagascar: La forêt de Zombitsy. Master’s thesis, geography. Université Michel de Montaigne-Bordeaux III.
- CABALZAR, G. (1993) Opération SAF-Côte Ouest. *Akon’ny Ala* 4: 21–22.
- CHARBONNIER, B. (1998) Limites et dynamique coutumière dans la forêt classée d’Ambohitelo, à l’intérieur de la cuvette de Didy S.E d’Ambatondrazaka. Master’s thesis in tropical rural forestry. Montpellier, France.
- COLEBROOK-ROBJENT, J. F. R. (1973) The breeding of the Madagascar Banded Kestrel (*Falco zoniventris*). *Bull. Brit. Orn. Club* 93: 108–111.
- COLLAR, N. J. AND STUART, S. N. (1998) *Key forests for threatened birds in Africa*. Cambridge, UK: International Council for Bird Preservation (Monogr. 3).
- COLSTON, P. R. (1972) A new bulbul from southwestern Madagascar. *Ibis* 114: 89–92.
- COMMISSION NATIONALE MALGACHE POUR L’UNESCO (1998) *Atelier d’identification des sites potentiels pour une Réserve de Biosphère Marine à Madagascar—16 au 18 novembre 1998. Tome 1: Présentation de l’atelier, Méthodologie, Résultats*. Antananarivo, Madagascar: UNESCO.
- CURL, D. A., SCOONES, I. C. AND GUY, M. K. (1985) The Madagascar Tortoise *Geochelone yniphora*; current status and distribution. *Biological Conservation* 34: 35–54.
- DANIELS, P. (1991) A first look at the Zahamena Reserve. *Tropicus* 5: 8–9.
- DECARY, R. (1932) Une mission au pays Sakalava. *L’Oiseau et RFO* 2: 520–529.
- DECARY, R. AND KIENER, A. (1970) Les cavités souterraines de Madagascar. *Annales de Spéléo. Paris* 25: 409–440.
- DELACOUR, J. (1930) Notes de Madagascar. *L’Oiseau* 2: 160–179.
- DELACOUR, J. (1932) Les oiseaux de la Mission Franco-Anglo-Américaine à Madagascar. *L’Oiseau et RFO* 2: 1–96.
- DELACOUR, J. AND BERLIOZ, J. (1931) Description d’oiseaux nouveaux de Madagascar. *L’Oiseau et RFO* 1: 1–5.
- DIRECTION DES EAUX ET FORÊTS (1996) Rapport de synthèse préliminaire, schéma d’aménagement—Forêt Classée d’Andavakoera. Projet COEFOR/CI et Projet KEPEM / USAID.
- DOMERGUE, C. A. (1986) La forêt du PK32 au nord de Toliara. Note préliminaire en vue de sa mise en réserve. *Bulletin de l’Académie Malgache* 61(1/2): 105–114.
- DUCKWORTH, J. W., EVANS, M. I., HAWKINS, A. F. A., SAFFORD, R. J. AND SHELDON, B. (1995) The lemurs of Marojejy Strict Reserve, Madagascar; a status overview with notes on ecology and threats. *International J. Primatology* 16: 545–559.
- DURAND, J. H., TREYER, M. AND ANDRIAMIHAINGO, M. (1966) *Recherche de sol à cocotier au nord d’Ambilobe*. Antananarivo: L’Institut de Recherche Agronomique de Madagascar (Document no. 95).
- DURBIN, J. C., RAJAFETRA, V., REID, D. B. AND RAZANDRIZANAKANIRINA, Y. D. (1996) Local people and Project Angonoka: conservation of the ploughshare tortoise, *Geochelone yniphora* in north-western Madagascar. *Oryx* 30: 113–120.

- DURRELL, L., GROOMBRIDGE, B., TONGE, S. AND BLOXAM, Q. (1989) *Acinixys planicauda* Madagascar Flat-tailed Tortoise, Kapidolo. In I. R. Swingland and M. W. Klemens, eds. *The conservation biology of tortoises*. Cambridge, UK: IUCN.
- EGUCHI, K., YAMAGISHI, S. AND RANDRIANASOLO, V. (1993) The composition and foraging behaviour of mixed species flocks of forest-living birds in Madagascar. *Ibis* 134: 91–96.
- EVANS, M. I. (1991) Red-tailed Newtonia (*Newtonia fanovanae*) in the Ambatovaky Reserve, north-east Madagascar. *Bird Conservation International* 1: 47–52.
- EVANS, M. I., DUCKWORTH, J. W., HAWKINS, A. F. A., SAFFORD, R. J., SHELDON, B. C. AND WILKINSON, R. J. (1992) Key bird species of Marojejy Strict Nature Reserve, Madagascar. *Bird Conservation International* 2: 201–220.
- EVANS, M. I., BISSET, P. G. AND BISSET, E. ((1994) A breeding colony of Yellow-billed Storks *Mycteria ibis* near Port Bergé, Madagascar. *Working Group on Birds in the Madagascar Region Newsletter* 4(1): 3–4.
- FARKAS, T. (1971) *Monticola bensoni*, a new species from south-western Madagascar. *Ostrich Supplement* 9: 83–90.
- FLANDEZ, M. S. AND ANDRIANARISATA, M. (1996) *Travaux sylvicoles dans la forêt d'Ankeniheny*. Antananarivo: COEFOR/CI.
- FORBES-WATSON, A. (1966) Observation at a nest of the Cuckoo-roller, *Leptosomus discolor*. *Ibis* 109: 425–431.
- FOWLER, S. V., CHAPMAN, P., CHECKLEY, D., HURD, S., MCHALE, M., RAMANGASON, G. S., RANDRIAMASY, J. E., STEWART, P., WALTERS, R. AND WILSON, J. M. (1989) Survey and management proposals for a tropical deciduous forest reserve at Ankarana in northern Madagascar. *Biological Conservation* 47: 297–314.
- GANZHORN, J. U. AND SORG, J. P., EDs. (1996) *Economy and ecology of a tropical dry forest in Madagascar*. Heidelberg, Germany: Springer Verlag (Primate Report 46[1]).
- GOODMAN, S. M., ED. (1997) A floral and faunal inventory of the eastern slopes of the Réserve Naturelle Intégrale d'Andringitra, Madagascar, with reference to elevational variation. *Fieldiana, Zoology*, new series 85: 1–319.
- GOODMAN, S. M., ED. (1998) A floral and faunal inventory of the Réserve Spéciale d'Anjanaharibe-Sud, Madagascar, with reference to elevational variation. *Fieldiana, Zoology*, new series 90: 1–246.
- GOODMAN, S. M. AND LANGRAND, O., EDs (1994) *Inventaire biologique: Forêt de Zombitse*. Antananarivo: Centre d'Information et de Documentation Scientifique et Technique (Recherches pour le Développement, Série Sciences Biologiques, No. Spécial).
- GOODMAN, S. M. AND SCHULENBERG, T. S. (1992) Report on a visit to Zahamena Reserve, 1991. Unpubl. report, Conservation International.
- GOODMAN, S. M., HAWKINS, A. F. A. AND DOMERGUE, C. A. (1997) A new species of Vanga (Vangidae) from south-western Madagascar. *Bull. Brit. Orn. Club* 117: 5–10.
- GOODMAN, S. M., LANGRAND, O. AND RAXWORTHY, C. J. (1992) Food of the Madagascar Long-eared Owl *Asio madagascariensis* in two habitats in southern Madagascar. *Ostrich* 64: 79–85.
- GOODMAN, S. M., PIDGEON, M., HAWKINS, A. F. A. AND SCHULENBERG, T. S. (1997) The birds of south-eastern Madagascar. *Fieldiana, Zoology* 87: 1–132.
- GREEN, A. J., YOUNG, H. G., RABARISOA, R., RAVONJIARISOA P. AND ANDRIANARIMISA, A. (1994) The dry season diurnal behaviour of the Madagascar teal *Anas bernieri* at Lac Bemamba. *Wildfowl* 45: 124–133.
- GREEN, G., GEZON, L. AND KOTTAK, C. (1991) Deforestation and the human role in environmental change in the Amber Mountain and Ankarana regions of Madagascar. Unpubl. report, University of Michigan.
- GRIVEAUD, P. (1960) Une mission de recherche de l'IRSM au Lac Ihotry (Sud-Est Morombe, province de Toliara). *Naturaliste Malgache* 12: 33–41.
- GRIVEAUD, P. AND PEYRIERAS, A. (1972) Compte-rendu des missions de mai-juin dans le massif de l'Andohahela et de l'Analavelona. Antananarivo: Centre d'Information et de Documentation Scientifique et Technique (Microfiche No.Mic-ORF 08419).
- GUILLAUMET, J.-L., BETSCH, J. M., BLANC, C., MORAT, P., PEYRIERAS, A. AND PAULIAN, R. (1973) Etude des écosystèmes montagnards dans la région malgache. Marojejy, Ireto et Ibity (géomorphologie, climatologie, faune et flore). *Bulletin du Musée National d'Histoire Naturelle* 309(3): 34–66.
- HAGEN, R. T. (1991) Proposition d'aménagement de la forêt classée de Tsitongambarika. Antananarivo, Madagascar: World Wide Fund for Nature.
- HALLEUX, D. AND GOODMAN, S. M. (1994) The rediscovery of the Madagascar Red Owl *Tyto soumagnei* (Granddidier 1878) in north-eastern Madagascar. *Bird Conservation International* 4: 305–311.
- HARTERT, E. (1912) On some unfigured birds (Plates 1 and 2). *Novitates Zoologicae* 19: 373–374.
- HAWKINS, A. F. A. (1993a) Species seen on Betsiboka river estuary, in collaboration with The Peregrine Fund. Unpubl. report. Copy available at ZICOMA Project.
- HAWKINS, A. F. A. (1993b) Relationships among vegetation structure and White-breasted Mesite (*Mesitornis variegata*) presence and foraging site choice. *Proceedings of the 8th Pan-African Ornithological Congress, Bujumbura, Burundi*.
- HAWKINS, A. F. A. (1994a) Black-naped Tern *Sterna sumatrana* in Madagascar. *Bull. Brit. Orn. Club* 114: 130.
- HAWKINS, A. F. A. (1994b) *Eupleres goudotii* in western Malagasy deciduous forest. *Small Mammal Conservation* 11: 20.
- HAWKINS, A. F. A. (1994c) Forest degradation and the west Malagasy forest bird community. Unpubl. PhD thesis, University of London.
- HAWKINS, A. F. A. (1994d) Conservation status and regional population estimates of the White-breasted Mesite (*Mesitornis variegata*), a rare Malagasy endemic. *Bird Conservation International* 4: 279–303.
- HAWKINS, A. F. A. (1994e) The nest of Schlegel's Asity *Philepitta schlegeli*. *Bull. African Bird Club* 1: 77–78.
- HAWKINS, A. F. A. (1995a) Observations on the foraging behaviour of the Short-legged Ground-roller *Brachypteracias leptosomus*. *Working Group on Birds in the Madagascar Region Newsletter* 5(2): 11–12.
- HAWKINS, A. F. A. (1995b) Bird species list from field mission west of Baly Bay. Unpubl. report to World Wide Fund for Nature—Madagascar.
- HAWKINS, A. F. A. (1995c) Recent observations of the western Tylas Vanga, *Tylas (eduardi) albicularis*. *Bull. African Bird Club* 2: 13–16.
- HAWKINS, A. F. A. (1995d) Ornithological Inventory and Survey. Zahamena Reserve Project. Report to Conservation International.
- HAWKINS, A. F. A. (1995e) Species list compiled during a visit 25–30 January 1995 to Cap Ste Marie. Unpubl. report. Copy available at ZICOMA Project.
- HAWKINS, A. F. A. (1996) Range extensions of some western Malagasy bird species. *Working Group on Birds in the Madagascar Region Newsletter* 6 (1): 54–55.
- HAWKINS, A. F. A. (1997) Report on ornithological inventory mission to Ambatovy. Unpubl. report. Copy available at ZICOMA Project.
- HAWKINS, A. F. A. AND DE VALOIS, P. (1993) Preliminary report on fieldwork in Baly Bay region, western Madagascar. Unpubl. report to Jersey Wildlife Preservation Trust (DWCT), Madagascar.
- HAWKINS, A. F. A. AND GOODMAN, S. M. (1999) The bird communities of Parcels 1 and 2 of the Parc National d'Andohahela, Madagascar. In S. M. Goodman, ed. A floral and faunal inventory of the Parc National d'Andohahela, Madagascar, with reference to altitudinal variation. *Fieldiana, Zoology*, new series.
- HAWKINS, A. F. A. AND RAHARIMALALA, F. (1995) Etude sur la flore et la faune dans le PN d'Isalo. Unpubl. report for ANGAP, Antananarivo, Madagascar.
- HAWKINS, A. F. A. AND WILMÉ, L. (1996) Effects of logging on forest birds. Pp. 203–213 in J. U. Ganzhorn and J. P. Sorg, eds. *Economy and ecology of a tropical dry forest in Madagascar*. Heidelberg, Germany: Springer Verlag (Primate Report: 46[1]).
- HAWKINS, A. F. A., ANDRIAMASIMANANA, R., THE SEING, S. AND RABEONY, Z. (2000) The sad story of Alaotra Grebe *Tachybaptus rufolavatus*. *Bull. African Bird Club* 7: 115–117.
- HAWKINS, A. F. A., ANDRIANARIMISA, A., RAKOTONOMENJANAHARY, O. M. AND RAMINOARISOA, V. (in press) Inventaire des oiseaux dans la Réserve Naturelle Intégrale de Zahamena. *Proc. 9th Pan-African Orn. Congress, Accra, Ghana*.
- HAWKINS, A. F. A., CHAPMAN, P., GANZHORN, J. U., BLOXAM, Q., TONGE, S. AND BARLOW, S. (1990) Vertebrate conservation in Ankarana Special Reserve, Northern Madagascar. *Biological Conservation* 54(2): 83–110.
- HAWKINS, A. F. A., DE VALOIS, P. AND RANDRIAMANANTENA, A. (1993) Report on fieldwork in Marofihitse, Amparehitse and Marofandilia regions, Morondava, 7th November–12th December 1992. Unpubl. report to Jersey Wildlife Preservation Trust (DWCT).
- HAWKINS, A. F. A., HOWE, E. AND HOWE, M. (1995) Madagascar Pratincole *Glareola ocularis* nesting in western Madagascar. *Working Group on Birds in the Madagascar Region Newsletter* 5 (1): 4.
- HAWKINS, A. F. A., GOODMAN, S. M. AND THIOLLAY, J.-M. (1998) The distribution and conservation of bird communities of the Réserve Spéciale d'Anjanaharibe-Sud, Madagascar. Pp. 93–128 in S. M. Goodman, ed. *A floral and faunal inventory of the Réserve Spéciale d'Anjanaharibe-Sud, Madagascar, with reference to elevational variation*. Chicago, USA: Field Museum (*Fieldiana, Zoology* 90).
- HAWKINS, A. F. A., RABENANDRASANA, M., MARIE CLÉMENTINE, V., RABEONY, O. M., MULDER, R., EMAHALALA, R. E. AND RAMARIASON, R. (1998) Field observations of the Red-shouldered Vanga *Calicalicus rufocarpalis*: a newly described Malagasy endemic. *Bull. African Bird Club* 5: 30–32.
- HINO, T. (1998) Mutualistic and commensal organisation of avian mixed species foraging flocks in a forest of western Madagascar. *J. Avian Biology* 29: 17–24.

- HIRSH, C. (1998) Brief report on the Mahavavy River rafting trip. Remote River Expeditions, Nairobi, Kenya.
- HLADIK, A. (1980) The dry forest of the west coast of Madagascar: climate, phenology, and food available for prosimians. Chapter 1 in P. Charles-Dominique, H. M. Cooper, A. Hladik, C. M. Hladik, C. Pages, G. F. Pariente, A. Petter-Rousseaux, A. Schilling and J.-J. Petter, eds. *Nocturnal malagasy primates: ecology, physiology and behaviour*. New York, USA: Academic Press.
- HUMBERT, H. (1955) Une merveille de la nature à Madagascar. Première exploration botanique du Massif de Marojejy et ses satellites. *Mémoires de l'Institut Scientifique de Madagascar, Série B, Tome VI*: 1–271.
- JENKINS, M. D., ED. (1987) *Madagascar—Profil de l'Environnement*. Cambridge, UK and Gland, Switzerland: IUCN.
- LANGRAND, O. (1987) Distribution, status and conservation of the Madagascar Fish-eagle *Haliaeetus vociferoides* Desmurs 1845. *Biological Conservation* 42: 73–77.
- LANGRAND, O. (1989) Search for the Madagascar serpent eagle. *Newsletter of world working group on birds of prey and owls* 10: 5–7.
- LANGRAND, O. (1990) *A field guide to the birds of Madagascar*. New Haven and London: Yale University Press.
- LANGRAND, O. (1995) Recensement des oiseaux d'eau et observation inattendue de la Sarcelle de Bernier (*Anas bernieri*). *Working Group on Birds in the Madagascar Region Newsletter* 5(1): 13–14.
- LANGRAND, O. (1996) Le rôle de la Réserve de Beza Mahafaly dans le contexte de la protection des oiseaux dans le sud-ouest de Madagascar. *Akon'ny Ala* 19: 14–17.
- LANGRAND, O. AND GOODMAN, S. (1995) Inventaire des oiseaux et des micromammifères des zones sommitales de la Réserve Naturelle Intégrale d'Andringitra. *Akon'ny Ala* 20: 39–54.
- LANGRAND, O. AND GOODMAN, S. (1996) Current distribution and status of Benson's Rockthrush, *Pseudocossyphus bensoni*, a Madagascar endemic. *Ostrich* 67: 49–54.
- LANGRAND, O. AND GOODMAN, S. M. (1997) *Inventaire biologique de la forêt de Vohibasia et d'Isoky-Vohimena*. Antananarivo: Ministère de la Recherche Scientifique (Recherches pour le Développement, Série Sciences Biologiques, No. 12).
- LANGRAND, O. AND LENORMAND, B. (1985) Présentation sommaire du Parc National de la Montagne d'Ambre. Pp. 260–264 in L. Rakotovo, V. Barre and J. Sayer, eds. *Actes du séminaire international sur l'équilibre des écosystèmes forestiers à Madagascar, 1985*. Gland, Switzerland: IUCN.
- LAUDAUD, L. AND POISSON, H. (1929) Contribution à l'étude de l'anatomie du *Monias benschi*. *L'Oiseau* 1: 665–670.
- LEANDRI, J. (1938) Visite à une Réserve Naturelle de l'Ouest de Madagascar: "La forêt de l'Antsingy". *La Terre et la Vie* [1938]: 18–27.
- MABBERLEY, D. J. (1997) *The Plant book*. 2nd Edition. Cambridge, UK: Cambridge University Press.
- MEYERS, D. M. AND RATSIRARSON, J. (1988) Distribution and conservation of two endangered Sifakas in northern Madagascar. *Primate Conservation* 10: 81–86.
- MILON, P. (1948a) Description d'une sous-espèce nouvelle de Madagascar: *Coua cristata maxima*. *Bulletin du Musée d'Histoire Naturelle de Paris* 1950: 65–67.
- MILON, P. (1948b) Deux jours au lac Tsimanampetsoa, observation ornithologique. *Naturaliste Malgache* 2: 61–67.
- MILON, P. (1948c) Notes d'observation à Madagascar II. Visites à Nosy-Manitra dans le sud-ouest de Madagascar. *Alauda* 16: 55–74.
- MILON, P. (1951) Etude d'une petite collection d'oiseaux de Tsaratanana. *Naturaliste Malgache* 2: 167–183.
- MILON, P. (1959) Observation biologique sur *Egretta garzetta dimorpha* à Madagascar. *Proc. 1st Pan-African Orn. Congress (Ostrich supplement 3)*.
- MITTERMEIER, R. A., TATTERSALL, I., KONSTANT, W. R., MEYERS, D. M. AND MAST, R. B. (1994) *Lemurs of Madagascar*. Washington, DC: Conservation International.
- MOUREAU, C. (1956) Notice sur la carte pédologique de reconnaissance au 1/200 000. Feuille No. 19 Maevatanana. *Mémoires de l'Institut Scientifique de Madagascar, Série D, Tome VII*.
- MUSTOE, S. (1997) Notes on Appert's Greenbul *Phyllastrephus apperti*, a poorly known endemic from the Zombitse-Vohibasia National Park in South-West Madagascar. Unpubl. report. Copy available at ZICOMA Project.
- MUSTOE, S.H., CAPPER, D. R., LOWEN, J. C., LEADLEY, J. H. AND RAKOTOMALALA, D. (1998) Zombitse-Vohibasia: a new national park in south-west Madagascar. *Bull. African Bird Club* 5: 39–45.
- NICOLL, M. E. AND LANGRAND, O. (1989) *Madagascar: Revue de la conservation et des aires protégées*. Gland, Switzerland: World Wide Fund for Nature International.
- ORGASYS (1996) Diagnostic de la situation écologique de Belo sur mer. Rapport préliminaire sur Marofihitse. Unpubl. report, BOIDEV/ORGASYS, Antananarivo, Madagascar.
- ORGASYS (1998) Diagnostic de la situation écologique de Midongy du Sud. Rapport final, février 1998: Liste faunistique inventoriée dans la région du Midongy du Sud. Report for ANGAP.
- PAULIAN, R. (1961) La faune cavernicole. In *Faune de Madagascar XIII, la Zoologie de Madagascar et des îles voisines*. Antananarivo: Institut de Recherche Scientifique.
- PAYNE, H. A. W. (1960) Bird species observed by H. A. W. Payne in Lac Mantasoa, Itasy, Alaotra, Andilamena, Antananarivo. Unpubl. report. Copy available at ZICOMA Project.
- PETIT, G. (1935) La Réserve Naturelle du Manampetsa (Madagascar). *Annales des Sciences Naturelles (B) Zoologie*, 10e sér., 18: 422–479.
- PETTER, J.-J. AND ANDRIATSARAFARA, S. (1987) Conservation status and distribution of lemurs in west and north-west Madagascar. *Primate Conservation* 7: 169–171.
- PIDGEON, M. (1996) *An ecological survey of Lac Alaotra and selected wetlands of central and eastern Madagascar in analysing the demise of the Madagascar pochard Aythya innotata*. Antananarivo: World Wide Fund for Nature and Missouri Botanical Garden.
- POLUNIN, N. V. C. (1979) *Sula leucogaster* and other species in the Isles Mitsios, Madagascar. *Bull. British Orn. Club* 99: 110–111.
- POWZYK, J. (1995a) Exceptional observations in Mantadia National Park. *Working Group on Birds in the Madagascar Region Newsletter* 5: 4.
- POWZYK, J. (1995b) Sighting of Madagascar Red Owl (*Tyto soumagnei*) in Mantadia National Park. *Working Group on Birds in the Madagascar Region Newsletter* 5: 5.
- PROJET CAF/APN (1998) Schéma d'Aménagement de la forêt villageoise de Farafara (FC Tsitongambarika). Preliminary report., World Wide Fund for Nature, Antananarivo, Madagascar.
- PROJET COEFOR/CI, SRF-DEF ((1993) *Répertoire et Carte de Distribution, Domaine Forestier National de Madagascar*. Antananarivo, Madagascar: COEFOR/CI.
- PRUM, R. O. AND RAZAFINDRATSITA, V. R. (1997) Lek behavior and natural history of Velvet Asity (*Philepitta castanea*: Eurylaimidae). *Wilson Bull.* 109: 371–392.
- RABARISOA, R. (1994) Survey of Madagascar Fish-Eagle—Mahajanga to Antsiranana. Unpubl. report, The Peregrine Fund, Boise, Idaho, USA.
- RABARISOA, R., WATSON, R. T., THORSTROM, R. AND BERKELMAN, J. (1995) Status of the Madagascar Fish-Eagle *Haliaeetus vociferoides* in 1995. *Ostrich* 68: 12.
- RAINIBERIAKA, M. AND TIDA, M. (1996) Inventaire floristique et forestier dans la forêt naturelle de Tsinjoarivo-Ambatolampy. Antananarivo: GTZ-PDFIV.
- RAKOTOARISON, N., MUTSCHLER, T., AND THALMANN, U. (1993) Lemurs in Bemaraha (World Heritage Landscape, western Madagascar). *Oryx* 27: 35–40.
- RAKOTOMANANA, H. (1998) Negative relationship between relative tarsus and wing lengths in Malagasy rain forest birds. *Japanese J. Orn.* 47: 1–9.
- RAKOTOMANANA, H. AND HINO, T. (1998) Fruit preference in the Velvet Asity *Philepitta castanea* in a rain forest of Madagascar. *Japanese J. Orn.* 47: 11–19.
- RAKOTONDRAVONY, D. AND GOODMAN, S. M. (1998) *Inventaire biologique de la forêt d'Andranomay-Anjozorobe*. Antananarivo: Ministère de la Recherche Scientifique (Recherches pour le Développement, Série Sciences biologiques, No. 12).
- RAKOTONOMENJANAHARY, M. O. (1996) *Etude des variations des communautés aviaires suivant l'habitat dans la R. S. de Beza Mahafaly*. Antananarivo: (Mémoire DEA-ESSA-Forêts).
- RAMANAMPAMONJY, J. R. (1995) Rencontre inattendue avec le Rôle d'Olivier (*Amaurornis olivieri*) au Lac Bemamba. *Working Group on Birds in the Madagascar Region Newsletter* 5(2): 5–7.
- RAMANDIMBISON (1995) Inventaire écologique de la Forêt Classée d'Andavakoera. Unpubl. report. USAID-Madagascar/KEPEM.
- RAMANGASON, G.-S. M. (1986) Analyse de la structure horizontale et verticale de la forêt sèche d'Ampijoroa. Doctoral thesis. Université d'Antananarivo, Madagascar.
- RAMANITRA, N. A. (1995a) Inventaire préliminaire de l'oiseaux du Tsingy de Bemaraha. *Working Group on Birds in the Madagascar Region Newsletter* 5(1): 7–10.
- RAMANITRA, N. A. (1995b) Notes sur les espèces aviennes observées dans la forêt d'Ambohitrambo Andranomay. Unpubl. report. Copy available at ZICOMA Project.
- RAMANITRA, N. A. (1997) *Contribution à l'étude de la faune ornithologique de la réserve de Bemaraha*. Antananarivo: Université d'Antananarivo (Mémoire de DEA—Filière Sciences Naturelles).
- RAMANITRA, N. A. AND RANDRIANASOLO, H. H. (1994) Inventaire des oiseaux dans la forêt de Tsिमembo et ses environs. In R. T. Watson, ed. *Madagascar Project, progress report 2, 1993 and 1994, Wetlands conservation project*. Boise, Idaho, USA: The Peregrine Fund.

- RAMANITRA, N. A., HAWKINS, A. F. A. AND RAKOTOFIRINGA, S. (1993) Comparaison de la communauté avienne de trois forêts de l'Ouest de Madagascar: Kirindy, Morondava, Tsimembo, Tsingy de Bemaraha. Presentation to the International Conference on the Biogeography of Madagascar, Paris, France, 26–28 septembre 1995.
- RAND, A. L. (1936) The distribution and habits of Madagascar birds. *Bull. Amer. Mus. Nat. Hist.* 72: 143–499.
- RAND, A. L. (1951) The nests and eggs of *Mesoenias unicolor* of Madagascar. *Auk* 68: 23–26.
- RANDRIAMANINDRY, J.-J. (1995) The Dusky greenbul *Phyllastrephus tenebrosus* in Zahamena Strict Reserve, Madagascar. *Working Group on Birds in the Madagascar Region Newsletter* 5(1): 1.
- RANDRIANASOLO, H. H. (1996) Présence de *Newtonia fanovanae* dans la forêt de Veveombe Vondrozo et note sur l'avifaune de cette région. *Working Group on Birds in the Madagascar Region Newsletter* 6(1): 14–18.
- RANDRIANTAVY (1993) La forêt de Zombitse. Master's thesis, geography stream. Université de Toliara, Madagascar.
- RAONDRY, N., KLEIN, M. AND RAKOTONIRINA, V. S. (1995) *La réserve de la biosphère de Mananara-Nord 1987–1994: Bilan et perspective*. Paris: UNESCO (Document de travail N°6).
- RASAMISON, F. (1993) Contribution de la population dans la protection des aires protégées d'Andasibe. Final dissertation, agronomy stream (water and forests). Université d'Antananarivo, Madagascar.
- RASOAVARIMANANA, M. A. (1988) Approche biogéographique de deux marais d'altitude: Les marais de Torotorofotsy Andasibe et de Kelimantsina Ambatomanoina. Master's thesis, geography stream. Université d'Antananarivo, Madagascar.
- RATSIMBA ARIMINO, T. (1998) Etude des potentialités écotouristiques de la région de Tsinojoarivo. Final dissertation, agronomy stream (water and forests). GTZ-PDFIV, Antananarivo, Madagascar.
- RAVELOSON, A. (1977) La pêche du Zompona aux Pangalane-Est (Section Ivondro-Rianila). Final dissertation, agronomy stream (water and forests). Université d'Antananarivo, Madagascar.
- RAVOAVY, A. T. (1996) Monographie de la commune de Lakato. Report to the Cantonement Forestier de Moramanga.
- RAXWORTHY, C. J. AND COLSTON, P. R. (1992) Conclusive evidence for the continuing existence of the Madagascar Serpent-eagle *Eutriorchis astur*. *Bull. Brit. Orn. Club* 112: 108–111.
- RAXWORTHY, C. J. AND NUSSBAUM, R. A. (1994) A rainforest survey of amphibians, reptiles and small mammals at Montagne d'Ambre, Madagascar. *Biological Conservation* 69: 65–73.
- RAZAFIMAHAIMODISON, J.-C. (1993) Inventaire ornithologique dans la forêt de Zombitse dans le sud-ouest de Madagascar. *Working Group on Birds in the Madagascar Region Newsletter* 3: 4–6.
- RAZAFIMAHAIMODISON, J.-C. AND ANDRIANANTENIAINA, R. (1993) Ecologie et comportement des groupes d'oiseaux dans une forêt dense humide de Madagascar. In *Proc. 8th Pan-African Orn. Congress, Bujumbura, Burundi*.
- RAZAFIMAHALEO, B. (1980) Aspect technique et économique des aménagements des vallées forestières au pays Zafimaniry. Final dissertation, agronomy stream (water and forests). Université d'Antananarivo, Madagascar.
- RAZAFINDRASOA, R. (1996) Contribution à l'inventaire des reptiles du site écotouristique de Nosy Mangabe. CAPEN/ENS dissertation, natural sciences stream. Université d'Antananarivo, Madagascar.
- RAZAFY, F. L. (1991) Etude de la dynamique de la végétation à Andasibe. DEA dissertation, natural sciences stream. Université d'Antananarivo, Madagascar.
- REID, D. R. (1992) Report of a visit to the habitat of the Angonoka to the west of the Bay of Baly from 25 September to 17 October 1991. Unpubl. report. Jersey Wildlife Preservation Trust.
- REID, D. R. AND HAWKINS, A. F. A. (1993) Species lists of birds, reptiles and mammals recorded from Namoroka Integral Reserve. Unpubl. report to ANGAP and the Direction des Eaux et Forêts. Jersey Wildlife Preservation Trust.
- REID, D. R., RAKOTONIAINA, L.-J., SMITH, L., JOBY, M., BOUROU, R. AND SIBO, C. (1995) Report of a field expedition to study the population and distribution of the Angonoka *Geochelone yniphora* on the west side of Baly Bay. Unpubl. report, Jersey Wildlife Preservation Trust, Antananarivo, Madagascar.
- REMILLET, M. (1973) Aperçu de la faune souterraine à Madagascar. Pp. 135–159 in *Livre du cinquantième de l'Institut de Spéléologie "Emile Recoovitz"*. Bucharest: Institut Spéléologie.
- ROSSI, G. (1977) Le Cap Saint-André (ouest de Madagascar). *Revue de Géographie (Université de Madagascar)* 30: 105–121.
- SAFFORD, R. J. (1993) The Madagascar teal: a preliminary survey from Antsalova to Morondava. *Dodo* 29: 95–102.
- SAFFORD, R. J. AND DUCKWORTH, J. W., EDS (1990) *A wildlife survey of Marojejy Nature Reserve, Madagascar: report of the Cambridge Madagascar Rainforest Expedition*. Cambridge, UK: International Council for Bird Preservation (ICBP Study Report no. 40).
- SAFFORD, R. J., HOOIJER, A. AND RAZAFINDRAJAO, F. (1998) Une étude de l'environnement de la région du Lac Sahaka. Unpubl. report. Royal Holloway Institute for Environmental Research, London, UK.
- SALMON, T. (1984) Field notes from Madagascar. Unpubl. report to the International Council for Bird Preservation. Cambridge, UK.
- SALOMONSEN, F. (1934a) Four new birds and a new genus from Madagascar. *Ibis* 13: 382–390.
- SALOMONSEN, F. (1934b) On a hitherto unknown fauna of montane birds in central Madagascar. *Novitates Zoologicae* 39: 207–215.
- SANA, M. F. (1987) Contribution à l'étude des problèmes cynégétiques dans le Faritany d'Antsiranana. Final dissertation, agronomy stream (water and forests). Université d'Antananarivo, Madagascar.
- SAF-CÔTE OUEST [SAUVEGARDE ET AMÉNAGEMENT DES FORÊTS—CÔTE OUEST] (1992) *La forêt dense sèche: dégradations et menaces*. Morondava, Madagascar: SAF-Côte Ouest.
- SCHMID, J., RAKOTONDRAPARANY, F., MÉDARD, J., RAFAMANTANANTSOA, C., RANDRIANARISON, J. V., RANAIVOJAONA, R., RANDRIANIRINA, J., RAKOTONDRAZIMBA, J. A., RABIBISOA, N., RAFANOMEZANTSOA, J., RABEMANANJARA, F., GIOVANNI BATTISTA, F., RAKOTOMANANA, H., RANDRIANASOLO, H., THE SEING, S., ANDRIAMAMPINANA, L., RATSIRARSON, H., RAZAKAMALALA, R., RANDRIANJANAKA, L. AND FIETZ, J. (1999) Programme d'inventaire biologique rapide (RAP), Corridor Mantadia-Zahamena. Preliminary report. Conservation International, Antananarivo, Madagascar.
- SCHULENBERG, T. S., GOODMAN, S. M. AND RAZAFIMAHAIMODISON, J.-C. (1993) Genetic variation in two subspecies of *Nesillas typica* (Sylviidae) in south-east Madagascar. In *Proc. 8th Pan-African Orn. Congress, Bujumbura, Burundi*.
- SCOTT, D. AND LUBBOCK, J. (1974) Preliminary observations on waterfowl of western Madagascar. *Wildfowl* 25: 117–120.
- SEDDON, N. (2001) The ecology, communication and conservation of the Subdesert Mesite *Monias benschi*. PhD thesis, University of Cambridge.
- SÉGALEN, P. (1956) Notice sur la carte pédologique de reconnaissance au 1/200 000. Feuille No. 13 Marovoay–Mahajamba. *Mémoires de l'Institut Scientifique de Madagascar, Série D, Tome VII*.
- SHELDON, B. AND DUCKWORTH, J. W. (1990) Rediscovery of the Madagascar serpent eagle *Eutriorchis astur*. *Bull. Brit. Orn. Club* 110: 126–130.
- SIEGFRIED, W. R. AND FOSTER, P. G. H. (1969) Notes on the Madagascar Kestrel *Falco newtoni*. *Ibis* 112: 400–402.
- SIMONS, E. L., GODFREY, L. R., VUILLAUME-RANDRIAMANANTENA, M., CHATRATH, P. S. AND GAGNON, M. (1990) Discovery of new giant subfossil lemurs in the Ankarana Mountains of northern Madagascar. *J. Human Evolution* 19: 311–319.
- STEINBACHER, J. (1972) Beiträge zur Vogelwelt von West-Madagascar. *Senckenbergiana Biologica* 53: 325–339.
- STEPHENSON, P. J. (1993) The small mammal fauna of Réserve Spéciale d'Analamazaotra, Madagascar: the effects of human disturbance on endemic species diversity. *Biodiversity and Conservation* 2: 603–615.
- STEPHENSON, P. J., ED. (1987) *Report of University of London expedition to Madagascar 1986*. London: Madagascar Environmental Research Group.
- TALLEC, F. (1996) Mise au point d'un modèle d'aménagement de la Forêt Classée d'Ankeniheny. Report to the COEFOR project.
- TERCINIER, G. (1952) Rapport sur la prospection pédologique de la région de Maevatanana, Ambato Boeni. *Mémoires de l'Institut Scientifique de Madagascar, Série D, Tome IV, Fascicule 2*.
- TERCINIER, G. (1952) *Rapport sur la prospection pédologique de la région de basse Mahavavy*. Antananarivo: ORSTOM.
- THALMANN, U. AND RAKOTOARISON, N. (1994) Distribution of lemurs in central Western Madagascar, with a regional distribution hypothesis. *Folia Primatologica* 64: 156–161.
- THIOLLAY, J.-M. (1998) The diurnal raptors (Falconiformes) of the Réserve Spéciale d'Anjanaharibe-Sud, Madagascar: abundance, distribution and conservation. Pp. 129–138 in S. M. Goodman, ed. *A floral and faunal inventory of the Réserve Spéciale d'Anjanaharibe-Sud, Madagascar, with reference to elevational variation*. Chicago, USA: Field Museum (*Fieldiana, Zoology* 90).
- THIOLLAY, J.-M. AND MEYBURG, B.-U. (1981) Remarques sur l'organisation d'un peuplement insulaire de rapaces à Madagascar. *Alauda* 49: 216–226.
- THOMPSON, P. M., ED. (1987) *Zahamena Forest (Madagascar) Expedition 1985*. Cambridge, UK: International Council for Bird Preservation (Study Report no. 20).
- THOMPSON, P. M. AND EVANS, M. I., EDS (1991) *A survey of Ambatovaky Special Reserve, Madagascar*. London: Madagascar Environmental Research Group.
- THOMPSON, P. M. AND EVANS, M. I. (1992) The threatened birds of Ambatovaky Special Reserve, Madagascar. *Bird Conservation International* 2: 221–237.
- THOMPSON, P. M., QUANSAH, N. AND RAXWORTHY, C. J., EDS (1988) *Manongarivo Special Reserve. Expedition report*. London: Madagascar Environmental Research Group.

- THORSTROM, R. AND RABARISOA, R. (1995) An observation of Madagascar teal, *Anas bernieri* in north western Madagascar. *Wildfowl* 48: 8–12.
- THORSTROM, R. AND WATSON, R. T. (1997) Avian inventory and key species of the Masoala Peninsula, Madagascar. *Bird Conservation International* 7: 90–115.
- THORSTROM, R., HART, J. AND WATSON, R. (1994) New record, ranging behaviour, vocalization and food of the Madagascar red owl *Tyto soumagnei*. *Ibis* 139: 477–481.
- THORSTROM, R., WATSON, R. T., DAMARY, B., TOTO, F., BABA, M. AND BABA, V. (1994) Repeated sightings and first capture of a live Madagascar serpent eagle, *Eutriorchis astur*. *Bull. Brit. Orn. Club* 115: 40–45.
- TURNER, D. A. (1981) A note on Bensch's Rail *Monias benschi* from Madagascar. *Bull. Brit. Orn. Club* 101: 240–241.
- URANO, E., YAMAGISHI, S., ANDRIANARIMISA, A. AND ANDRIATSARAFARA, S. (1992) Different height use among three sympatric species of couas in a dry forest at Ampijoroa, western Madagascar. Chapter 10 in S. Yamagishi, ed. *Social structure of Madagascar higher vertebrates in relation to their adaptive radiation*. Osaka, Japan: Osaka City University.
- VOOUS, K. H. AND PAYNE, H. A. W. (1965) The grebes of Madagascar. *Ardea* 53: 9–31.
- WALTER, H. (1979) *Eleonora's Falcon: adaptation to prey and habitat in social raptor*. Chicago, USA: University of Chicago Press.
- WALTERS, R., WILSON, J., FOWLER, S., RANDRIAMASY, J., STEWART, P., CHAPMAN, P., MCHALE, M., CHECKLEY, D., RAKOTOZAFY A., RADOFILAO, J. AND HURD, S. (1986) The crocodile caves of Ankarana. Unpubl. report to WWF—Madagascar.
- WATSON, R. T., BERKELMAN, J., LEWIS, R. AND RAZAFINDRAMANANA, S. (1993) Conservation studies on the Madagascar Fish-Eagle *Haliaeetus vociferoides*. In *Proc. 8th Pan-African Orn. Congress, Bujumbura, Burundi*.
- WELCH, C. AND KATZ, A. (1992) Survey and census work on lemurs in the natural reserve of Betampona in eastern Madagascar with a view to reintroductions. *Dodo* 28: 45–58.
- WERDING, G. (1972) Vom Vogelleben in Madagaskar. *Gefiederte Welt* 96: 194–196, 211–213.
- WILDLIFE CONSERVATION SOCIETY (1995) Document principal sur la proposition des limites du parc Masoala. Extraits de l'ancien Document de projet des limites du parc Masoala, Annexes I à IV.
- WILMÉ, L. (1993) Status, distribution and conservation of two Madagascar bird species endemic to Lake Alaotra: Delacour's grebe *Podiceps rufolavatus* and Madagascar pochard *Aythya innotata*. *Biological Conservation* 69: 15–21.
- WILMÉ, L. AND LANGRAND, O. (1990) Rediscovery of Slender-billed Flufftail *Sarothrura watersi* Bartlett 1879 and notes on the genus *Sarothrura* in Madagascar. *Biological Conservation* 54: 211–223.
- WILSON, J. M. (1985) Ecology of the crocodile caves of Ankarana, Madagascar. *Cave Science* 12(3): 135–138.
- WILSON, J. M., STEWART, P. D. AND FOWLER, S. V. (1987) Ankarana, a rediscovered nature reserve in northern Madagascar. *Oryx* 22: 163–170.
- WORLD WIDE FUND FOR NATURE—MADAGASCAR (1997) *Atelier sur les Zones Humides de Madagascar*. Antananarivo, Madagascar: World Wide Fund for Nature.
- WOZENCRAFT, J. C. (1986) A new species of striped mongoose from Madagascar. *J. Mammalogy* 67: 561–571.
- YAMAGISHI, S., URANO, E. AND EGUCHI, K. (1995) Group composition and contributions to breeding in Rufous Vangas *Schetba rufa* in Madagascar. *Ibis* 137: 157–161.
- YOUNG, H. G. AND SAFFORD, R. J. (1995) Annotated list of the birds of Lac Bemamba area. *Working Group on Birds in the Madagascar Region Newsletter* 5(2): 14–19.
- YOUNG, H. G. AND SMITH, J. G. (1989) The search for the Madagascar pochard *Aythya innotata*; survey of Lac Alaotra, Madagascar, October–November 1989. *Dodo* 26: 17–34.
- YOUNG, H. G., SAFFORD, R. J., GREEN, A., RAVONJARISSA, P. AND RABARISOA, R. G. M. (1993) Survey and capture of the Madagascar teal at Lac Bemamba. *Dodo* 29: 77–94.
- ZACK, S. (1994) An ornithological training course manual. Unpubl. report to Ranomafana Project, Madagascar.

