

## World Heritage Sites

### Protected Areas and World Heritage



## ALDABRA ATOLL SEYCHELLES

*Aldabra is one of the most isolated ecoregions on Earth and its second largest raised atoll reef. It is formed of four large coral islands which enclose a shallow lagoon surrounded by reefs. Owing to its isolation, lack of water and difficulty of access, human influence on Aldabra has been relatively little. It therefore retains over 100,000 giant tortoises, the world's largest population of this animal, and the island's corals, which are prolific on the north and west coasts, form an ideal natural milieu for studying tropical marine corals as do the lagoons for the study of mangroves and seagrasses.*

### COUNTRY

Seychelles

### NAME

Aldabra Atoll

### NATURAL WORLD HERITAGE SITE

1982: Inscribed on the World Heritage List under Natural Criteria vii, ix and x.

### STATEMENT OF OUTSTANDING UNIVERSAL VALUE

The UNESCO World Heritage Committee issued the following Statement of Outstanding Universal Value at the time of inscription:

#### Brief Synthesis

Located in the Indian Ocean, the Aldabra Atoll is an outstanding example of a raised coral atoll. Due to its remoteness and inaccessibility, the atoll has remained largely untouched by humans for the majority of its existence. Aldabra is one of the largest atolls in the world, and contains one of the most important natural habitats for studying evolutionary and ecological processes. It is home to the largest giant tortoise population in the world. The richness and diversity of the ocean and landscapes result in an array of colours and formations that contribute to the atoll's scenic and aesthetic appeal.

**Criterion (vii):** Aldabra Atoll consists of four main islands of coral limestone separated by narrow passes and enclosing a large shallow lagoon, providing a superlative spectacle of natural phenomena. The lagoon contains many smaller islands and the entire atoll is surrounded by an outer fringing reef. Geomorphologic processes have produced a rugged topography, which supports a variety of habitats with a relatively rich biota for an oceanic island and a high degree of endemism. Marine habitats range from coral reefs to seagrass beds and mangrove mudflats with minimal human impact.

**Criterion (ix):** The property is an outstanding example of an oceanic island ecosystem in which evolutionary processes are active within a rich biota. Most of the land surface comprises ancient coral reef (~125,000 years old) which has been repeatedly raised above sea level. The size and morphological diversity of the atoll has permitted the development of a variety of discrete insular communities with a high incidence of endemism among the constituent species. The top of the terrestrial food chain is, unusually, occupied by an herbivore: the giant tortoise. The tortoises feed on grasses and shrubbery, including plants which have evolved in response to its grazing patterns. The atoll's isolation has also allowed the evolution of endemic flora and fauna. Due to minimal human interference, these ecological processes can be clearly observed in their full complexity.

**Criterion (x):** Aldabra provides an outstanding natural laboratory for scientific research and discovery. The atoll constitutes a refuge for over 400 endemic species and subspecies (including vertebrates, invertebrates and plants). These include a population of over 100,000 Aldabra Giant Tortoise. The tortoises are the last survivors of a life form once found on other Indian Ocean islands and Aldabra is now their only remaining habitat. The tortoise population is the largest in the world and is entirely self-sustaining: all the elements of its intricate interrelationship with the natural environment are evident. There are also globally important breeding populations of endangered green turtles, and critically endangered hawksbill turtles are also present. The property is a significant natural habitat for birds, with two recorded endemic species (Aldabra Brush Warbler and Aldabra Drongo), and another eleven birds which have distinct subspecies, amongst which is the White-throated Rail, the last remaining flightless bird of the Western Indian Ocean. There are vast waterbird colonies including the second largest frigatebird colonies in the world and one of the world's only two oceanic flamingo populations. The pristine fringing reef system and coral habitat are in excellent health and distinguished by their intactness and the sheer abundance and size of species contained within them.

#### **Integrity**

The property includes the four main islands which form the atoll plus numerous islets and the surrounding marine area. It is sufficiently large to support all ongoing biological and ecological processes essential for ensuring continued evolution in the atoll. The remoteness and inaccessibility of the atoll limit extensive human interference which could otherwise jeopardize ongoing processes. As such, Aldabra displays an almost intact ecosystem, sustaining naturally viable populations of all key species.

#### **Protection and Management Requirements**

The property is legally protected under national legislation and is managed by a public trust, the Seychelles Islands Foundation, with daily operations guided by a management plan. Boundaries are ecologically viable but the extension of the seaward boundary some 20 km into the sea would provide additional protection to the marine fauna. While the remoteness of the property has limited human interference, thus contributing for the protection of the biological and ecological processes, it also poses tremendous logistical challenges. Tourism is limited and carefully controlled. Whilst the property displays an almost intact ecosystem, protection and management need to address the constant threats posed by invasive alien species, climate change and oil spills, particularly in the event that oil exploration increases in the wider region.

#### **INTERNATIONAL DESIGNATION**

2009: Designated a Wetland of International Importance under the Ramsar Convention (43,900 ha);

#### **IUCN MANAGEMENT CATEGORY**

1a Strict Nature Reserve

#### **BIOGEOGRAPHICAL PROVINCE**

Comores Islands and Aldabra (3.24.13)

#### **GEOGRAPHICAL LOCATION**

Isolated atoll in the Indian ocean at the northern entrance to the Mozambique Channel. Approximately 420 km north-west of Madagascar, 700 km east of the East African mainland and 1200 km southwest of Mahé in the Seychelles, at 9°25'S, 46°25'E.

#### **DATES AND HISTORY OF ESTABLISHMENT**

1976: Designated a Strict Nature Reserve under the Protection and Preservation of Wild Life Ordinance of 1970. The Royal Society of London acquired a 14-year lease from the Government of the British Indian Ocean Territory.

1980: The lease on the atoll assumed by the Seychelles Islands Foundation (SIF), a charitable trust established under the Seychelles Islands Foundation Decree of 1979;

1981: Designated a Special Reserve under the Seychelles National Parks & Nature Conservancy Act.

#### **LAND TENURE**

Government. Administered by the Seychelles Island Foundation.

## AREA

35,000 ha. Terrestrial: 18,800 ha; Mangrove: 2,000 ha; Marine: 14,200 ha.  
The reserve extends to one kilometre from the perimeter high water mark.

## ALTITUDE

Most of the atoll is about 8m above sea-level.

## PHYSICAL FEATURES

The Aldabra group comprises Aldabra atoll and the small scattered atolls of Assumption, Astove and Cosmoledo and forms one of the most isolated ecoregions in the world. Aldabra is one of the world's largest raised coral atolls, 34 km long by a maximum of 14.5 km across. In form it is a classic coral atoll which has been built up from the seabed in which narrow islands averaging 2 km wide surround a wide shallow lagoon. The four main islands, separated by narrow passes, are Grande Terre, the largest, Malabar, Picard and Polymnie. Most of the land surface comprises ancient coral reef about 125,000 years old now raised above sea-level in two platforms, at 4m and 8m, the rest being even older reef limestones. They surround a lagoon, 2-3m deep at low tide, covering some 19,000 ha which contains many islets (Stobart *et al.*, 2001). There is good coral reef growth on the northern and western coasts of the atoll, but coral growth on the southern coast is less prolific (reefs are dominated by calcareous algae), and the very exposed eastern coast is probably dominated by calcareous algae and rubble.

Geomorphological processes have produced a varied and rugged topography which has undergone several emergences and submergences during its history. Just 4,000 years ago, sea-levels in the Western Indian Ocean were several metres higher than at present. However, due to its relative height Aldabra's last submergence was probably about 125,000 years ago. Weathering has eroded the limestone into sharp spikes and pits over much of the islands, although the surface at the eastern end is formed of raised lagoonal sediments. The limestone cliffs along the coast are undercut, and there are a perched beach and sand dunes on the southern coast which faces the prevailing winds. Pits in the limestone contain fresh or brackish water that sits on top of surrounding seawater as a lens and rises and falls with the tides. The lagoon at Aldabra is linked to the ocean by two major and one smaller channels and by several smaller reef passages. The tidal range is more than three metres which can induce strong currents through the channels between the lagoon and open ocean. The main channel alone drains approximately 60% of the lagoon (Stoddart, 1971). The island was hardly affected by the 2004 tsunami.

## CLIMATE

The climate is tropical with a mean annual temperature of 27°C, a monthly mean maximum in December of 31°C and mean minimum in August of 22°C. The average rainfall is about 1,100mm, although the rainfall varies greatly between years. The climate is heavily influenced by northwest monsoon winds from November to March which bring the heaviest rainfall. Southeastern tradewinds blow the remainder of the year which is drier. The area is occasionally affected by cyclones. The coral suffered from the unusually strong 1997-8 El Niño Southern Oscillation.

## VEGETATION

The vegetation of Aldabra is unusually rich and varied for an isolated atoll, where the terrestrial flora includes some 178 species of indigenous flowering plants, of which about 8% (15 species) are thought to be endemic to Aldabra or the Aldabra group. Many of these plants are considered to be threatened. These include the Aldabra lily *Lomatophyllum aldabrense*, a rare pandan *Pandanus aldabraensis* and a small herb *Hypoestes aldabrensis*. 50% of the fretted limestone terrain is covered with dense salt-tolerant scrub thicket of *Pemphis acidula* with other salt-tolerant species along the south coast which is exposed to strong southeasterly winds. Mixed scrub of different species covers 19% of the islands, dominating more sheltered areas. On flat limestone, there is a mixed growth of low trees, forming 'groves' in some areas, shrubs, herbs and grasses, including seasonal grasslands and a vegetation type known as tortoise turf, grazed by giant tortoises which contains several species that are genetically dwarfed. On the west and north coasts, are a few places where coconut groves and small areas of *Casuarina equisetifolia* have

established (SIF, pers. comm., 2006). Mangrove swamp, covering some 17% of the land surface, grows around the edge of the lagoon, and inshore waters support sea-grass meadows. The percentages are cited from Bourn & Goodridge (2004).

## FAUNA

Owing to its remoteness, lack of fresh water, dense scrub and difficult terrain, Aldabra's ecosystem has survived relatively intact, although turtles, tortoises, shells, mangroves and some birds were once extensively exploited. There are 100 species of birds (Lepage, 2010). Aldabra is unusual for a tropical island of its size in having almost no introduced avifauna, and the endemism of terrestrial flora and fauna is high. Of the 13 land birds two species and 11 sub-species are endemic. Endemic insects form some 38% of the estimated 1,000 species. The only indigenous mammals are Seychelles flying fox *Pteropus seychellensis* and three insectivorous bats: Mauritian tomb bat *Taphozous mauritanus*, Trouessart's trident bat *Triaenops furculus* and *Chaerephon pusilla*. Feral goats, cats and black rats *Rattus rattus* are a threat to nesting birds. The island group is one of the world's few areas where reptiles dominate the terrestrial fauna. It is the home of the world's largest tortoise, the endemic Aldabra giant tortoise *Geochelone gigantea* (VU) and the world's largest number of such animals. It was estimated in 1997 to have a self-sustaining population of 100,000, 94,000 living on the largest island (ERGO, 1997), though a total population of 200,000 is quoted in Ahamada *et al.* (2004). The atoll is an important refuge for coconut crab *Birgus latro*, which has disappeared from most other islands in the Seychelles (SIF, pers. comm., 1995). Hawksbill turtle *Eretmochelys imbricata* (CR) and green turtle *Chelonia mydas* (EN) breed there; dugongs *Dugon dugong* (VU) and spinner dolphin *Stenella longirostris* are reported by Aldabra Marine Programme scientists, and humpback whales *Megaptera novaeangliae* and whale sharks *Rhincodon typus* (VU) have been sighted. Other marine animals are reported on a regular basis (SIF, pers. comm., 2006).

The endemic bird species include the last of the western Indian Ocean flightless birds - the near-threatened endemic Aldabra drongo *Dicrurus aldabranus* (about 1,500) which inhabits scrub, mangrove and casuarina thickets, and the Comoro blue pigeon *Alectroenas sganzi* which is endemic to the Comoros. The Aldabra brush warbler *Nesillas aldabranus* (EX), first seen in 1967, has not been seen since 1984 and is assumed extinct. Previously restricted to 10 ha of coastal tall scrub, it was considered possibly the most endangered bird in the world, as only five birds had been seen since its discovery (Collar & Stuart, 1985). Aldabra is the main breeding site in the Indian Ocean for the red-tailed tropic bird *Phaethon rubricauda*, red-footed booby *Sula sula*, greater and lesser frigatebirds *Fregata minor* and *F. ariel*. There are also large numbers of white-tailed tropic bird *Phaeton lepturus*, masked booby *Sula dactylatra* and brown booby *S. leucogaster*. Thousands of nesting terns are also found on the atoll (SI, pers. comm., 1995). Audubon's shearwater *Puffinus lherminieri colstoni*, a race described in 1996, is apparently confined to Aldabra.

Other species are Madagascar pond-heron *Ardeola idea* (EN), sacred ibis *Threskiornis aethiopica abbotti* (100-250 pairs), Madagascar kestrel *Falco newtoni aldabranus*, white-throated rail *Dryolimnas cuvieri aldabranus* (about 5,000), Madagascar turtle-dove *Nesoenas picturata coppingeri*, Madagascar bulbul *Hypsipetes madagascariensis rostratus*, Madagascar coucal *Centropus toulou insularis*, Madagascar nightjar *Caprimulgus madagascariensis aldabrensis*, Aldabran drongo *Dryolimnas cuvieri aldabranus* (about 5,000), Madagascar white-eye *Zosterops maderaspatana aldabrensis*, forest fody *Foudia omissa*, of a genus confined to the western Indian Ocean, and Souimanga sunbird *Nectarina sovimanga*, Aldabra's commonest landbird. In 1995 and 1996 breeding Greater Flamingo *Phoenicopterus ruber* were discovered, and there are 52 species of migrant landbirds.

A survey in 1998 by the Cambridge Coastal Research Unit (Cambridge University) recorded 287 species of fish before the bleaching event, but since 1999 an annual average of only 210 species has been reported (Ahamada *et al.*, 2004), with variations depending on the different habitats sampled. Several species of harks, rays and barracudas are common in the lagoon. As an unaltered atoll Aldabra is a valuable site for the long-term monitoring of coral reefs which occur on the sides of the atoll least affected by the southeastern tradewinds. The atoll's remoteness has preserved it from most threats but during the 1997-8 El Niño it suffered extensive bleaching. For four months the sea surface temperatures were the

highest noted for 35 years: 1.3°C above normal. The outer reef slopes from the western to northeastern shores (with a 37% coral cover) suffered 41% coral mortality. 38% mortality was recorded at 20m depth and 68% at 10m depth, with little recovery of hard corals though soft corals have increased considerably in some locations (Stobart *et al.*, 2005). Shallower areas under 10m suffered the most. Mortality was particularly high in the branching corals: *Acropora* spp., *Pocillopora* spp., *Millepora* spp. (fire coral) and *Heliopora* spp. (blue coral); death in massive corals such as *Porites* spp., *Favia* spp., *Pavona* spp. and *Diploastrea* spp. was in most cases partial and spatially patchy (Aldabra Marine Programme, 2006). Survival in the shallow lagoon suggests some pre-adaptation to temperature stress (Stobart *et al.*, 2001). Bleaching was also widespread in other marine organisms. However, by 2004 live reefs covered up to 58% of areas shallower than 10m and up to 52% in deeper areas, and over 90 species had been recorded (Ahamada *et al.*, 2004). A separate survey by Sheppard and Obura in 2005, recorded 201 species for Aldabra and Cosmoledo Islands together.

## **CONSERVATION VALUE**

Aldabra is one of the only relatively undisturbed island systems of any size anywhere in the world. It is small and morphologically diverse with a variety of discrete insular floral and faunal communities, with a high incidence of endemism and is unique in having no introduced species of birds. It is a refuge for the last giant tortoise and flightless bird populations of the Western Indian Ocean, as well a substantial marine turtle breeding population and large seabird colonies. It lies within a WWF Global 200 Marine Eco-region, within a Conservation International Hotspot, has been declared a Ramsar Wetland and is a BirdLife-designated Endemic Bird Area.

## **CULTURAL HERITAGE**

The name is probably derived from the Arabic, meaning 'green'. The first claimants were French in the mid-18<sup>th</sup> century, hence the nomenclature. But in 1810 the island became a British dependency of Mauritius. The ruggedness and lack of water preserved it from permanent human presence, but this was threatened in the late 19<sup>th</sup> century when short-term leases were granted and a small settlement was established of which the tiny church and jail remain (SIF, pers. comm., 1995).

## **LOCAL HUMAN POPULATION**

No permanent settlement exists but there is a fluctuating research population of 8 to 10 Seychelles Islands Foundation employees and visiting scientists.

## **VISITORS AND VISITOR FACILITIES**

Access is difficult except by cruise ship, by chartered boat from Mahé, 3½ days away or from an airstrip on Assumption Island, 3 hours away by boat. At present only some 200 divers visit each year. The scientists' accommodation in the research station is available to tourists when not occupied. In 2003 to raise revenue to pay for the island's maintenance, the Seychelles government proposed a 12-unit luxury chalet development on the footings of the old settlement buildings on Picard Island (earthdive, 2004), but this has since been abandoned.

## **SCIENTIFIC RESEARCH AND FACILITIES**

Aldabra is an ideal natural laboratory for the study of tropical marine ecosystems. Consistent scientific inquiry began in the late 19<sup>th</sup> century and the history of conservation on Aldabra to that date is described in Stoddart (1971). There have been several studies of the reef fish from 1899 onward and the coral reef was first studied during the 1970s. A research station was established on the atoll in 1971. The subsequent work of the London Royal Society made Aldabra one of the best known and most researched atoll ecosystems in the world. Intensive research programs for the atoll were pursued between 1967 and 1979, focussing mainly on the land. Notable were a study of the now extinct Aldabra warbler by Prys-Jones (1979) and a WWF-funded survey and monitoring of the tortoise and turtle populations began in 1982. Additional studies have been carried out regularly by scientists from the Smithsonian Institution and Cambridge University. In 1998 the Cambridge Southern Seychelles Atoll Research Programme surveyed the effect of coral bleaching and recorded fish populations. The Aldabra Marine Programme, set up in

1999 by a group of marine scientists independent of SIF though working in agreement with it, monitors marine conditions following the bleaching event. It established 11 permanent survey sites, plus others on three related islands, and conducted regular brief comparative surveys in 1999 and annually between 2001 and 2005 (Aldabra Marine Programme, 2006). A new research station was completed in 1996 with funds from the Global Environmental Facility (GEF), and is maintained by the Seychelles Islands Foundation. It has accommodation for up to 15 scientists and volunteers. The Seychelles Government maintains a meteorological station.

## MANAGEMENT

Since the 19th century short-term leases on the island existed with varying amounts of protection and control over exploitation into the 1960s, when it became part of the British Indian Ocean Territory. An attempt to create a military base was rebuffed by scientists in a media campaign to save the atoll and the lease transferred to the Royal Society of London in 1967. Since 1981, the sole management authority for Aldabra has been the Seychelles Islands Foundation, a quasi-governmental authority. Protective regulations (the Aldabra Special Reserve Regulations) under the National Parks and Nature Conservancy Act came into force in 1981. Previously, only partial protection for specified animals was provided. The Aldabra Marine Programme researches the marine environment in collaboration with SIF.

The principal present policy is to maintain minimum human interference while continuing the research and monitoring programs. Successive development plans have stressed provision for the economic development of the outer islands of the Seychelles. At present development is restricted to small-scale tourism, deep-sea fishing and the very limited exploitation of some natural resources. In 1996 the World Bank via the GEF funded a complete Management, Science and Conservation Plan for Aldabra drawn up by the Seychelles Islands Foundation which acts been as a guideline for the management of the atoll. This was due for review and update in 2006. A Science Programme Review workshop was held in 2005. Aldabra was chosen in 2001 as one of ten pilot World Heritage Sites to undergo a full management effectiveness evaluation, the UNESCO/IUCN 'Enhancing our Heritage' project, a process ongoing in 2006. In addition, the Aldabra Foundation has been established as a fund-raising and awareness raising body (SIF, 1995)

## MANAGEMENT CONSTRAINTS

Apart from the drastic effect of global warming and some effects of illegal fishing, damage to the marine environment is minimal at present. But oil spills from passing tankers and an oil terminal proposed on Astove Island, from which Aldabra is directly downstream, are potential threats (AMP, 2005). On land, mangroves were formerly cut for wood, and fish, tortoises, shells and seabirds were taken, though their populations have recovered. But the difficulties of effectively patrolling the atoll and easy access from the sea, threaten the integrity of the Reserve through the unauthorised export of tortoises and turtles, disturbance of seabird colonies and other wildlife, and the hazard of fire.

Introduced rats and cats are well established, but the originally large population of goats have been considerably reduced with UNESCO support through two eradication campaigns in 1987 and 1988 and subsequently, on Malabar and Grande Terre islands when approximately 75-85% of the total population was culled. The proliferation of mealy bug, accidentally introduced into Aldabra, seriously damaged native vegetation, particularly endemic species. A program of biological control of this species, through the introduction of a specific coccinellid predator was launched in 1988 with ORSTOM assistance (M. Marieu, pers. comm., 1990). Attempts have been made to control the spread of exotic plants though coconut palms, *Casuarina equisetifolia* and *Stachytarpheta jamaicensis* are established.

The maintenance of effective conservation, and the realisation of the full scientific value of the site, depend on the ability of the SIF to support adequate wardening staff and a functioning research station. However, the Foundation itself has been dependent mainly upon visitor entrance fees to Vallée de Mai on Praslin Island, the other Seychelles World Heritage site managed by SIF, and on subscription and donation income, resulting in a reliance on the notoriously fickle tourism industry. Shortage of funds is

therefore a potential danger. At present a dozen corporations and institutions support the research work voluntarily (SIF, 1995).

## STAFF

An Island Manager and a Research Officer seconded from the Department of the Environment and appointed by the Seychelles Islands Foundation, with eight to ten resident SIF employees (SIF, 2006).

## BUDGET

In 1981 US\$534,000 was raised by appeal. In 1982 a £45,000 (US\$80,000) annual grant was received, one-third of it from the Seychelles Government. In the past regular contributions from the Royal Society, the Smithsonian Institution and the Seychelles Government, with occasional donations, provided about 20% of the Foundation's revenues. In 1996 the GEF funded a management plan. Financial support for projects under the Coral Reef Degradation in the Indian Ocean Programme (CORDIO) is provided from numerous sources. The Aldabra Marine Programme has primarily been funded by Total Elf, TUI and many private donors. According to SIF, \$500,000 a year was needed in 2003 to maintain Aldabra (earthdive, 2004). Revenues from the popular Vallée de Mai still contribute largely to its upkeep. As part of the Enhancing our Heritage project, the Shell Foundation assisted in the upgrading of the budgetary system of SIF. In 2005 the Aldabra Foundation, a Swiss-registered charity, was established with the aim of setting up a \$20,000,000 trustee fund over 5-7 years.

## LOCAL ADDRESS

The Chairman, Seychelles Islands Foundation, PO Box 853, Victoria, Mahé, Seychelles.

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**DATE**

1984. Updated 4-1990, 10-1995, 9-2006, 12-2010, 5-2011, January 2012.