

Information Sheet on Ramsar Wetlands (RIS) – 2006-2008 version

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Categories approved by Recommendation 4.7 (1990), as amended by Resolution VIII.13 of the 8th Conference of the Contracting Parties (2002) and Resolutions IX.1 Annex B, IX.6, IX.21 and IX. 22 of the 9th Conference of the Contracting Parties (2005).

1. Name and address of the compiler of this form:

Dr Nancy Bunbury (nancy@sif.sc)
Seychelles Islands Foundation
P O Box 853
Victoria, Mahé, Seychelles

Contact person:

Dr Frauke Fleischer-Dogley (ceo@sif.sc)
Chief Executive Officer, Seychelles Islands Foundation (address as above)

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Designation date

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Site Reference Number

2. Date this sheet was completed: 24 April 2009

3. Country: Seychelles

4. Name of the Ramsar site: Aldabra Atoll

5. Designation of new Ramsar site or update of existing site:

This RIS is for (a) Designation of a new Ramsar site - **X**

6. For RIS updates only, changes to the site since its designation or earlier update: Not applicable.

7. Map of site:

a) A map of the site, with clearly delineated boundaries, is included as:

- i) a hard copy (required for inclusion of site in the Ramsar List): ;
- ii) an electronic format (e.g. a JPEG or ArcView image) ;
- iii) a GIS file providing geo-referenced site boundary vectors and attribute tables .

b) Describe briefly the type of boundary delineation applied: The boundary is the same as the World Heritage site designation for Aldabra; following the contour surrounding the Atoll *ca* 1 km offshore from the shoreline. It includes the entire terrestrial area and lagoon as well as much of the fringing reef system.

8. Geographical coordinates (latitude/longitude, in degrees and minutes):

South West Corner: 9° 29' S, 46° 13' E; North East Corner: 9° 23' S, 46° 31' E; Centre of site: 9° 24' S, 46° 20' E; Research Station: 9° 24' S, 46° 12' E. The proposed site consists of one discrete unit.

9. General location:

Aldabra Atoll is an outer island of the Seychelles archipelago in the Western Indian Ocean (WIO) lying 1150 km southwest from the Seychelles main island of Mahé, 650 km from the east coast of Africa, and 420 km north of Madagascar. The closest airstrip is 35km to the south east, on the island

of Assumption. The Aldabra group comprises Aldabra atoll and the atolls of Assumption, Astove and Cosmoledo.

10. Elevation: (in metres: average and/or maximum & minimum)

Average: 4 m (Range: mostly 0–8 m; highpoint: 19m)

11. Area: (in hectares)

Total area for proposed Ramsar designation: 43 900 hectares

Total landmass: 18 800 ha

Total lagoon area: 14 200 ha

Total marine area (1km buffer region around the atoll): 8900 ha

Total mangrove area: 2000 ha

12. General overview of the site:

Aldabra Atoll, designated a UNESCO World Heritage site in 1982, is the largest raised coral atoll in the world. Aldabra is widely recognised as one of the most remarkable and least disturbed oceanic islands on Earth, an outstanding example of a raised coral atoll, a global benchmark for marine, coastal and terrestrial ecosystems in an undisturbed state and a refuge for many endangered and unique species. Aldabra comprises a unique mixture of wetlands; seven of the Ramsar recognized Marine/Coastal wetland types, and two freshwater wetland types are found on and around the atoll, all within the proposed site. Aldabra has been recognised as a global biodiversity hotspot (Conservation International), an International Endemic and Important Bird Area (BirdLife International) and a Global 200 marine and terrestrial ecoregion ('Alliance for Zero Extinction'; WWF). Aldabra is inhabited by over 400 endemic species and subspecies (including birds, mammals, reptiles, invertebrates and plants) to the atoll. The pristine fringing reef system and coral habitat are in excellent health and their intactness and the sheer abundance of species contained within them are rarely paralleled in similar ecosystems.

13. Ramsar Criteria:

1 • 2 • 3 • 4 • 5 • 6 • 7 8 • 9

14. Justification for the application of each Criterion listed in 13 above:

Criterion 1: A wetland should be considered internationally important if it contains a representative, rare, or unique example of a natural or near-natural wetland type found within the appropriate biogeographic region.

Aldabra is the largest raised coral atoll in the world. At the scale of the Afrotropical biogeographical region, such a globally representative site for marine and coastal wetland types is rare. Notably, the atoll remains relatively undisturbed and is therefore in a more natural state than many human-modified or influenced wetland sites. The mangrove ecosystem of Aldabra is undisturbed and the coral reefs are important and relatively pristine (Spalding *et al.* 2001). By designating the entire atoll of Aldabra a Ramsar site, a number of these closely occurring and interlinked wetland ecosystem types will be included in the designation. These include mangroves (of which eight species occur on Aldabra), coral reef, atoll channels and seagrass beds, which are sub-units of the entire ecological system of Aldabra, so must be considered together. By combining designation for all ecosystem types of Aldabra, listing the atoll as a Ramsar site will act as a valuable tool to safeguard coastal processes in the area.

At the finer spatial scale of the WWF Global Ecoregions, Aldabra is globally unique, and contains its own ecoregion (Aldabra Island xeric scrub - AT1301). The inland freshwater, brackish and marine pools are unusual and varied, and provide habitat for a range of species.

Criterion 2: A wetland should be considered internationally important if it supports vulnerable, endangered, or critically endangered species or threatened ecological communities.

Aldabra supports a large number of globally threatened species, subspecies and ecological communities including:

- The largest nesting population in the WIO of the green turtle *Chelonia mydas* (Endangered; several thousand females/year nest on the atoll).
- A breeding population of the hawksbill turtle *Eretmochelys imbricata* (Critically Endangered).
- The world's only population of the Aldabra fruit bat *Pteropus seychellensis aldabrensis* (Hill 1971; Vulnerable).
- The world's largest remaining population and the last extant species in the Indian Ocean of giant tortoise, the Aldabra giant tortoise *Geochelone gigantea* (Vulnerable).
- A small population of dugongs *Dugong dugong* (Vulnerable), which are rare in the WIO.
- A breeding population of the Madagascar pond-heron *Ardeola idae* (Endangered), which is apparently declining in all other parts of its breeding range.
- Large ray and shark populations in the lagoon and waters around Aldabra, many species of which are globally threatened or near threatened, including the whale shark *Rhincodon typus* (Vulnerable). Sharks as a group are severely threatened worldwide and require urgent protection.
- Under the WWF's Global Ecoregion classification scheme, the vegetation of Aldabra is classified as a globally unique type, namely Aldabra Island xeric scrub (AT1301). The vegetation is relatively stable and intact, but its global uniqueness warrants conservation attention.

Criterion 3: A wetland should be considered internationally important if it supports populations of plant and/or animal species important for maintaining the biological diversity of a particular biogeographic region.

The biological diversity of Aldabra is unquestionably important for the region. Aldabra is a centre of endemism with over 400 species and subspecies which are endemic to the atoll and many other species which are native to the Aldabra group and region. Examples of this endemism include:

- Exceptional richness in plants (unusually for an atoll) with 176 recorded native species and 40 species which are endemic to Aldabra or the Aldabra group (Beaver & Chong-Seng 1995).
- The largest and last endemic population of giant tortoises in the Indian Ocean.
- Two endemic species of insectivorous bat (*Chaerephon pusillus* and *Triaenops pauliani*), both of which are newly assigned/described and yet to be assigned an IUCN threat category (Goodman & Ratrimomanarivo 2007, Goodman & Ranivo 2008).
- Eleven extant endemic species and subspecies of landbird including the endemic Aldabra white-throated rail *Dryolimnas cuvieri aldabranus*, and the Aldabra drongo *Dicrurus aldabranus*, an endemic species to Aldabra with ca. 1500 birds (Skerrett 1995).
- An endemic subspecies of Madagascar sacred ibis *Threskiornis aethiopicus abbotti*.
- The world's only population of the Aldabra fruit bat *Pteropus seychellensis aldabrensis*, an endemic subspecies to Aldabra (Goodman & Ranivo 2008).
- Around 380 insect species are considered endemic to the atoll (Gerlach & Gerlach 1995).
- Aldabra's is also classified as its own globally unique ecoregion by the WWF Global Ecoregions scheme (Aldabra Island xeric scrub - AT1301).

Additionally, Aldabra is home to the only remaining species of giant tortoise in the Indian Ocean, all other giant tortoise species across the region (those endemic to the inner Seychelles, Mauritius and Rodrigues) having been extirpated by humans. This tortoise occurs in huge numbers on Aldabra (at over 100,000 individuals, the population is over 10 times the size of the famed Galapagos population), where it is endemic, but it is also being used across the region as an ecological analogue species to functionally replace extinct species. Giant tortoises have tremendous ecological importance on oceanic islands where they are the only or among the very few large native browsers and seed

dispersers, as well as providing an effective and large-scale means of returning nutrients to the shallow soil. Aldabra's tortoise population is therefore of great importance to the entire WIO region.

Criterion 4: A wetland should be considered internationally important if it supports plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions.

The combination of mangrove, coral reef, seagrass bed, beach and channel habitat types occurring on Aldabra provides a complex system of support for multiple stages of the life cycle of many different species. For example, for green and hawksbill turtles, the shallow waters of the fringing reef provide ideal mating areas, the beaches are used by nesting females and juvenile turtles take refuge within the mangroves and channels of the lagoon.

Six species of mangrove occur on Aldabra comprising large areas of intertidal forest around the lagoon. This habitat type has a complex ecological and physical structure which provides refuge sites and is important for the persistence of populations of many migratory and non-migratory species. For example, juvenile green and hawksbill turtles along with many species of fish, shelter and forage among the mangrove roots.

Criterion 5: A wetland should be considered internationally important if it regularly supports 20,000 or more waterbirds.

Aldabra regularly supports well over 20,000 and probably over 50,000 waterbirds in total including:

- Approx. 6000 pairs of greater and 4000 pairs of lesser frigate bird (Reville 1983) in addition to thousands of non-breeding birds (peak can be as high as 27,000 frigatebirds in total; Skerrett 1995)
- Up to 3800 crab plovers (Pistorius & Taylor 2008).
- 4000–5000 pairs of red-footed booby *Sula sula* (Skerrett 1995).
- Approx. 1800 pairs of red-tailed tropicbird *Phaethon rubricauda* and 2400 pairs of white-tailed tropicbird *P. lepturus* (Skerrett 1995).
- Populations of breeding and wintering wader including dimorphic egret, great white egret, cattle egret, sacred ibis, green-backed heron, grey heron, whimbrel, bar-tailed godwit, greenshank.
- One of only two oceanic breeding colonies of greater flamingo *Phoenicopterus ruber roseus* in the world (the other being in the Galapagos) of approx. 50 birds and the only site at which flamingos occur in the Seychelles.
- Five species of breeding tern, for all of which Aldabra is the largest population in Seychelles: the Caspian tern *Sterna caspia* (Aldabra is the only oceanic site at which it breeds); the white tern *Gygis alba*; the crested tern *Thalasseus bergii*; the black-naped tern *Sterna sumatrana* (for which Aldabra is the largest population in Africa); and the brown noddy *Anous stolidus*.

Criterion 6: A wetland should be considered internationally important if it regularly supports 1% of the individuals in a population of one species or subspecies of waterbird.

Aldabra regularly supports >1% of the global populations of and is therefore of considerable importance to the following waterbird species:

- Crab plover *Dromas ardeola* (4–6% of the global population overwinter making Aldabra a wintering area of international importance for this species; Pistorius & Taylor 2008).
- Greater frigatebird *Fregata minor* (ca. 3.5% of global population of ~340,000 birds; based on figures from IUCN Red List 2008 and Reville 1983; Aldabra is the second largest breeding colony in the world for this species).
- Lesser frigatebird *F. ariel* (ca. 4% of global population of ~200,000 birds; based on figures from IUCN Red List 2008 and Reville 1983; Aldabra is the second largest breeding colony in the world for this species).
- Red-tailed tropicbird *Phaethon rubricauda* (>10% of global population of ~32,000 birds; based on figures from IUCN Red List 2008 and Skerrett 1995).

- White-tailed tropicbird *P. lepturus* (~9.5% of global population of ~50,000 birds; based on figures from IUCN Red List 2008 and Skerrett 1995).
- Madagascar sacred ibis *Threskiornis aethiopicus abbotti* (100% of global population; endemic subspecies to Aldabra; Skerrett 1995)

Criterion 7: A wetland should be considered internationally important if it supports a significant proportion of indigenous fish subspecies, species or families, life-history stages, species interactions and/or populations that are representative of wetland benefits and/or values and thereby contributes to global biological diversity.

Endemism in reef fish is uncommon and because Aldabra is a coral atoll, very few of the several hundred (> 500) species of fish which occur in its waters are endemic at species or even subspecies level. The undisturbed mangrove and reef systems of Aldabra, however, provide important refuge areas for many of these fish species, and the sheer abundance and diversity of fish around the atoll merits noting here and warrants further research. In addition, being an undisturbed and protected site, fish at Aldabra grow much larger than individuals of the same species at most other Seychelles sites outside the Aldabra group. The Aldabra group is therefore a critical location site for long-lived large-bodied fish to attain their full size, and such individuals are of great importance for population recruitment. The wealth of fish species and the habitats found around Aldabra can therefore be considered to contribute to global biological diversity, as well as providing a refuge at a crucially important stage in the life history of long-lived fish species.

Criterion 8: A wetland should be considered internationally important if it is an important source of food for fishes, spawning ground, nursery and/or migration path on which fish stocks, either within the wetland or elsewhere, depend.

Aldabra, with its complex of mangroves, coral reefs and seagrass beds and its abundance of life, provides important food sources for fish as spawning grounds (e.g. for reef fish) and nursery areas.

- The Aldabra lagoon contains a large amount of coral reef unaffected by the 1998 bleaching episode which decimated corals across the Seychelles region. The lagoon's corals are therefore likely to act as a spawning source of coral larvae for other sites in the area (A. Hagan, pers. comm.).
- The lagoon and shallow waters surrounding Aldabra provide protected nursery areas for a number of shark species including the blacktip shark *Carcharhinus limbatus*, lemon shark *Negaprion brevirostris*, and grey reef shark *Carcharhinus amblyrhynchos*. Other common sharks found in the waters around Aldabra include the silvertip shark *Carcharhinus albimarginatus*, tawny nurse shark *Nebrius ferrugineus*, bull shark *Carcharhinus leucas*, tiger shark *Galeocerdo cuvier* and scalloped hammerhead shark *Sphyrna lewini* (Stevens 1984).
- Extensive mangrove areas throughout the lagoon provide shelter and sources of food for fish and juvenile turtles.
- Aldabra is on the migration paths of the whale shark *Rhincodon typus* and the humpback whale *Megaptera novaeangliae* (Hermans & Pistorius 2008).

Criterion 9: A wetland should be considered internationally important if it regularly supports 1% of the individuals in a population of one species or subspecies of wetland-dependent non-avian animal species.

Aldabra supports:

- 100% of the populations of two species of insectivorous bat (*Chaerephon pusillus* and *Triaenops pauliani*), both of which are endemic to Aldabra (Goodman & Ratrimomanarivo 2007, Goodman & Ranivo 2008).
- 100% of the population of the endemic fruitbat subspecies *Pteropus seychellensis aldabranus*.
- 100% of the endemic gecko subspecies *Phelsuma abbotti abbotti*.
- >95% of the endemic Aldabra giant tortoise *Geochelone gigantea* (with populations on other islands in the Indian Ocean having been introduced).

- >1% of the total adult populations of coconut crabs *Birgus latro*.
- >1% of the Indian Ocean population of green turtles *Chelonia mydas*

15. Biogeography:

a) Biogeographic region:

Broadly, Aldabra is in the Afrotropical biogeographic region. At a finer scale, WWF recognise a number of 'ecoregions' in which Aldabra is classified as its own globally unique ecoregion (WWF Global Ecoregions scheme; Aldabra Island xeric scrub - AT1301), one of the designated 'Global 200' ecoregions which represent the Earth's most distinctive and rich natural wealth.

b) Biogeographic regionalisation scheme:

WWF Global Ecoregion approach (WWF 2008),

(http://www.panda.org/about_wwf/where_we_work/ecoregions/about/) Accessed: 27th February 2009.

16. Physical features of the site:

Geology and geomorphology.—Aldabra is 34 km long and a maximum of 14.5 km across. The atoll consists of four main islands around a vast (140 km²) central lagoon bordered by four main channel areas. Its form is that of a classic coral atoll in which narrow islands averaging 2 km wide surround a wide shallow lagoon. The four main islands, in descending order of size, are Grande Terre, Malabar, Picard and Polymnie. Most of the land surface comprises ancient coral reef about 125,000 years old now raised above sea level. The origin of Aldabra is entirely natural, with the atoll's raised coral reef forming on the summit of an underwater mountain as it gradually emerged and submerged, continuing to maintain itself at sea level with the rising and falling of the atoll over time. At the end of the last ice age, the sea level rose and eventually breached the sides of the island to form the lagoon and atoll we see today.

Geomorphological processes have produced a varied and rugged topography. Exposed rocks reveal a complex series of erosional and depositional events consisting of shallow water marine limestone's, limited terrestrial calcarenites, calcareous soils and cavity fill, and some phosphorites (Taylor *et al.* 1979). Aldabra has undergone up to six submergences during its history and was probably last submerged *ca.* 125,000 years ago. Weathering has eroded the Aldabra's limestone into sharp spikes and pits across much of the terrestrial area, which has created a very harsh terrain called 'champignon' (Trudgill 1979a). The champignon cliffs along the coast are undercut, and there are beach and sand dunes on the southern coast, which faces the prevailing winds. Pits in the champignon contain fresh or brackish water that sits atop the surrounding seawater and rises and falls with the tides.

Water depth, permanence, quality, and level fluctuations with tide.—The 14,200 ha lagoon is 2-3m deep at low tide, with many exposed sand and seagrass beds, and many smaller islets. The lagoon is linked to the ocean by three major and several smaller channels. An estimated 1 million m³ of water drains in and out of the lagoon with each change of tide. The tides create strong currents through the channels between the lagoon and the open ocean. The main channel alone drains approximately 60% of the lagoon. Sea level height at Aldabra varies from +0.3–1.8 m at low tide to 2.6–4.1m at high tide, thus the maximum tidal range is *ca.* 3.8m. The surrounding ocean is 4000m deep (Stoddart *et al.* 1971). Few data are available on water quality, although as an undisturbed and isolated site it is presumed to contain few pollutants.

Soil type.—Soils on Aldabra are patchily distributed, and consist mainly of pockets of shallow (10–20cm) organic matter or biogenic mineral detritus. The mineral soils are primarily carbonate and derived mechanically by weathering of carbonate rocks. Soils have low phosphate levels, and can be slightly acidic but are mostly circumneutral or alkaline with high salinity close to the coast (Trudgill 1979b). Insufficient profile data is available to define soil types and spatial distribution.

Climate.—Aldabra has a seasonal climate typical of the tropics. There is a wet and a dry season and, although annual rainfall varies considerably, it averages 1100mm (Stoddart 1983). The majority of

rainfall occurs during the north-west monsoon (typically Nov–Apr). The south-east trade winds blow during May–Oct when rainfall is scarce and droughts of 10–12 months have been recorded. Aldabra has a mean temperature of 27.0°C with an annual range of approximately 3.4°C. The highest and lowest recorded temperatures on Aldabra are 36.3°C and 17.5°C respectively.

17. Physical features of the catchment area:

Please see Point 16 above, which contains all relevant information on the catchment area.

18. Hydrological values:

No information is known about Aldabra's hydrological values.

19. Wetland Types

These are: Permanent shallow marine waters (Ramsar designation A); Marine subtidal aquatic seagrass beds (B); Coral reefs (C); Rocky marine shores (D); Sandy shores, sand bars and dune systems (E); Intertidal mud and sand flats (G); Intertidal forested wetlands –mangrove swamps (I); Coastal brackish/saline lagoons with several connections to the ocean (J); Permanent saline/brackish pools (Sp); Seasonal saline/brackish pools (Ss); and Seasonal freshwater pools in coral/limestone holes (Ts).

a) Presence:

Wetland types of the Ramsar Classification System present at Aldabra are underlined:

Marine/coastal: A • B • C • D • E • F • G • H • I • J • K • Zk(a)

Inland: L • M • N • O • P • Q • R • Sp • Ss • Tp • Ts • U • Va •

Vt • W • Xf • Xp • Y • Zg • Zk(b)

Human-made: n/a

b) Dominance:

Accurately assessing the dominance of wetland types is not possible until the whole area has been accurately mapped, a project which is currently underway. It is known that permanent shallow marine waters (A) are the most dominant wetland type, followed by (not in order) coastal saline lagoon area (J), marine subtidal aquatic seagrass beds (B) and mangrove swamps (I).

20. General ecological features:

The main wetland habitats are described above (19 a & b) but the terrestrial vegetation of Aldabra is also immensely varied and unusually rich for an isolated atoll. In addition to mangroves, two other major plant communities form the bulk of the vegetation cover: pemphis scrub and mixed scrub. The mixed scrub type is extremely heterogenous and contains the maximum variety of plant and animal species including areas of 'tortoise turf', which is made up of 22 species, eight of which are endemic to Aldabra and 12 of which are 'genetically dwarfed'. Rarely for an ecosystem, the dominant terrestrial species is a herbivore; the giant tortoise, which acts as an 'ecosystem engineer', maintaining lawns of tortoise turf and, over time, moulding plant adaptations with their constant grazing, leading to the traits of heterophlly and dwarfism shown by some of its favoured food species. Land crabs of 24 species are the largest of the atoll's terrestrial invertebrates and occupy most habitats as the most important scavengers and detritivores.

According to the MA definition of ecosystem services as "the benefits that humans receive from ecosystems", Aldabra provides few directly measurable ecosystem services simply because there are so few humans living on or close to the atoll. Indirect and currently immeasurable ecosystem services include Aldabra's role as a spawning ground and nursery for coral, fish and crab species and its status as a benchmark for an undisturbed ecosystem, which has great value for science and environmental knowledge.

21. Noteworthy flora:

Of the endemic flora to Aldabra, the beautiful Aldabra lily *Lomatophyllum aldabraense* is probably the best known and most spectacular. There is also an endemic subspecies of tropicbird orchid *Angraecum eburneum* which is found on some of the small islets, an endemic screwpine *Pandanus aldabrensis*, found only in a few areas, two species of endemic *Grewia*, and a few common shrubs and smaller plants making up the tortoise turf. There are also a number of species of endemic lichen, although it is likely that there are still many more which remain unidentified. The xeric scrub (see point 14; Criteria 1 & 2) is classified as its own eco-region, making it of high biogeographical significance.

22. Noteworthy fauna:

The dominant animal species on Aldabra, the giant tortoise, is notable for several reasons. It is the last extant giant tortoise population in the Indian Ocean region, all others on the Seychelles and Mascarene archipelagos having been lost over the last 300 years. Because of these losses and the resulting absence of large herbivores on these islands, the Aldabra tortoise is now being used as ecological analogue species for habitat restoration on Mauritius, Rodrigues, Round Island, Ile aux Aigrettes and other Seychelles islands where its congeners used to occur. The Aldabra population is the largest population of giant tortoises in the world; at *ca.* 100,000 individuals it is around ten times larger than the famous population of Galapagos tortoises. Indeed, the Galapagos and Aldabra species are now the only extant species of giant tortoise in the world. The species is also notable for its relatively flat face and ability to drink through its nostrils, which enables it to utilise the very shallow pools typical on Aldabra for drinking water.

More green turtles (Endangered) breed on Aldabra than at any other site in the region and the atoll is also a breeding area for hawksbill turtles (Critically Endangered). In some pools on the atoll, the unusual 'upside-down jellyfish' *Cassiopea* sp. occurs in abundance.

Probably the most noteworthy bird inhabiting the atoll is the Aldabra rail *Dryolimnas cuvieri aldabranus*, the last surviving flightless bird in the Indian Ocean. There were once many species of flightless bird (rails and pigeons and relatives) across the Indian Ocean and all except the Aldabra rail have been extirpated by humans for easy food. The Aldabra rail is therefore very precious and molecular genetic research (in planning) may confirm it as a distinct species.

23. Social and cultural values:

a) Social and/or cultural values

Aldabra's human history is short but there are some buildings of cultural value on the atoll which remain following the first settlement. The settlement was established in the late 19th century and the remains include some houses, a tiny church and a jail, which are now part of the tourist attraction of the 'old settlement'. Aldabra also has significant socio-economic importance for the Seychelles as an ecotourism destination. A number of traditional medicinal plants also grow on Aldabra but these are not harvested.

b) International importance for examples of significant cultural values?

Not applicable.

24. Land tenure/ownership:

a) Within the Ramsar site:

Aldabra belongs to the Seychelles government but was leased to the Seychelles Islands Foundation for 99 years from 1979.

b) In the surrounding area:

The Exclusive Economic Zone (EEZ) of the Seychelles extends 200km around Aldabra.

25. Current land (including water) use:

a) Within the Ramsar site:

In general, current land use on Aldabra Atoll is extremely low. The number of permanent staff on the atoll is 10–12 individuals. Since there is no freshwater, water use is limited to the collection of rainwater, and a small desalination unit. No other extractive use is performed on the marine water resources. All refuse is stored within metal containers and shipped to Mahé. Most organic waste is used to fertilise a small vegetable garden. Human waste is stored in septic tanks. A small boat shed houses fuel for electric diesel generators and to run service boats – the only major pollution source. Well monitored and very low impact subsistence fishing for staff use only is conducted on the outer reef. There are six field camps across Aldabra, which accommodate staff conducting biological monitoring or visiting researchers in remote locations. Most regions are rarely visited by humans. Tourists rarely stay overnight, are only permitted on the island of Picard, and there only on designated areas. They are allowed water based activities elsewhere (although no fishing or motorized sport is allowed). An education outreach program houses around 15 school children plus teachers on Aldabra annually.

b) In the surroundings/catchment:

Its remote location means that very few vessels/humans ever reach Aldabra. It is also outside all major shipping lanes. The occasional tourist vessel or private yacht can only moor and land on Aldabra, in designated areas, with prior consent from the managing authority, the Seychelles Islands Foundation. All guests are required to supply their own water, and remove their refuse.

26. Factors (past, present or potential) adversely affecting the site's ecological character, including changes in land (including water) use and development projects:

a) Within the Ramsar site:

Although major human populations have not settled on Aldabra, which has limited anthropogenic impact, the atoll has been exploited in the past. Early sailors and settlers slaughtered many giant tortoises and turtles for food, and built a settlement in the area. No further development projects are planned.

Major threats to Aldabra Atoll are:

Oil spill.—An oil spill is the most serious potential threat to Aldabra's biodiversity as the atoll is very close to a marine highway used by oil tankers en route to and from the oil fields off northern Madagascar.

Climate change.—Climate change poses a similarly serious threat to Aldabra as it does to all low-lying islands. The effects of climate change are difficult to predict but there will almost certainly be a major impact on the coral reef and other sensitive areas (during the 1998 coral bleaching event, hard coral mortality around Aldabra was estimated at 40-60%). Since the site is only slightly above sea level it is particularly vulnerable to coastal erosion and sea level rise. Turtle nesting beaches are also vulnerable. Long-term climate monitoring is underway to detect any changes.

Alien invasive species introduction and establishment.—Introduced species are a past, present and potential threat. Goats *Capra hircus*, rats *Rattus rattus* and cats *Felis catus* have already become naturalised and are undoubtedly affecting biodiversity. An extensive goat eradication program, initiated in 2006 is close to eradicating the entire goat population. However, cats and rats, which occur on most islands, still pose a threat, particularly to nesting seabirds and landbirds. Damage by the invasive coccid, *Icerya seychellarum*, has greatly affected certain plant species and caused reduced growth and mortality in some, including rare species (Newbury 1980). There is a risk of further plant/animal introductions from other islands, e.g. red-whiskered bulbuls from Assumption (Roberts 1988), which SIF is involved in plans to eradicate in the near future. With these species could also come introduced diseases, which could seriously affect the endemic wildlife.

b) In the surrounding area:

Illegal fishing and poaching.—Poaching is a present threat with the potential to increase, since vessels can often enter the area undetected and poaching of fish and turtles has been known to occur.

Ocean refuse.—An as yet unassessed threat is that posed by rubbish washed ashore from the ocean. The southern and eastern shorelines in particular are littered with refuse on the shoreline. These may affect shorebirds and nesting success and health of marine turtles.

27. Conservation measures taken:

a) List national and/or international category and legal status of protected areas, including boundary relationships with the Ramsar site:

Aldabra Atoll is recognised in its entirety as a UNESCO Natural World Heritage site since 1982 (Reference number 185; fulfils criteria vii, ix, x; <http://whc.unesco.org/en/list/185>).

The proposed Ramsar site covers the exact delineation of the World Heritage site delineation.

b) If appropriate, list the IUCN (1994) protected areas category/ies which apply to the site (tick the box or boxes as appropriate):

Ia Ib ; II ; III ; IV ; V ; VI

c) Does an officially approved management plan exist; and is it being implemented?:

Yes. The Seychelles Islands Foundation was established in 1979 by Presidential Decree to manage and protect Aldabra Atoll (and later the Vallée De Mai Natural World Heritage Site) in its entirety. A management plan was drawn up in 1998 and is being implemented.

d) Describe any other current management practices:

The atoll is managed as a strict nature reserve with very limited access to visitors. The scientific importance of Aldabra means that the atoll is used primarily for research and monitoring.

28. Conservation measures proposed but not yet implemented:

In addition to the ongoing refinement and recommendations of the comprehensive management plan already being implemented for Aldabra, SIF is currently working to increase the protective buffer zone around Aldabra from 1 km to 30 km offshore to reduce the threats of a major oil spill and poaching in the vicinity. Measures to prevent future species introductions from staff activities, supplies and tourist visits are also being established as a formal quarantine protocol. There are also a number of ongoing and planned projects targeted at individual species or ecosystems to determine status, trends and threats.

29. Current scientific research and facilities:

A research station was established by the Royal Society of London in the 1960s, which has been continually upgraded since and still provides a base for conducting long term monitoring on the atoll. It consists of a laboratory with basic field sampling equipment, satellite internet connection, a small library and office space with computer facilities. Aldabra has an active research program and is used by visiting researchers, who conduct work on a variety of projects in collaboration with SIF. A volunteer program is also in operation to allow young graduates the opportunity to help with station logistics and monitoring activities and also, occasionally, to conduct individual projects. Examples of stand-alone research projects carried out by independent researchers and volunteers conducted in 2008/2009 include:

- Long-term fish and coral monitoring to determine reef resilience (in collaboration with AMP)
- Remote sensing of the Aldabra lagoon and terrestrial area for digital maps (in collaboration with the Cambridge Coastal Research Unit)
- Population status and habitat use of the Endangered Madagascar pond-heron *Ardeola idea*.
- Foraging ecology of the Endangered green turtle *Chelonia mydas*.
- Taxonomy and conservation status of the two endemic bat species to Aldabra (in collaboration with Prof. Steve Goodman).
- Taxonomy and distribution of major disease vectors, e.g. mosquitoes and sandflies (Paris NHM).

In addition to the above projects, extensive long-term biodiversity monitoring programmes are also conducted on the atoll. These include:

- Climate (rainfall and temperature data since 1960s)
- Marine turtle (green and hawksbill) track counts, breeding and tagging
- Aldabra giant tortoise abundance and distribution
- Phenology monitoring of native and endemic plants
- Landbird surveys and wader counts
- Robber crab survey and sampling
- Red-tailed tropicbirds breeding
- Butterflyfish transects

30. Current communications, education and public awareness (CEPA) activities related to or benefiting the site:

On Aldabra, there is a visitors' information centre, and SIF staff guide tourists on well marked trails around Picard Island. A variety of popular leaflets, and presentations are available for distribution.

An 'EcoSchool' program was established in partnership with the Environmental Education section of the Ministry of Environment in 1999, and includes an annual trip to Aldabra for children from the winning schools. Groups of approximately 15 children get the opportunity to visit and learn about Aldabra and the event receives considerable local publicity.

Two educational books for children about Aldabra and coastal ecology and management are currently being designed and prepared as part of an SIF project. One book will be targeted at primary and one at secondary school level and books will be distributed to all schools in the Seychelles free of charge. News updates on Aldabra are regularly reported in the Seychelles daily national newspaper, *The Nation*.

31. Current recreation and tourism:

Because of its remote location, relatively few visitors reach Aldabra Atoll, and their presence and activities are strictly controlled. Fewer than 1000 tourists and 200 divers visit per year, mainly from cruise ships, private yachts or chartered boats. These are only allowed to moor in designated areas with permanent mooring buoys. Low impact diving and snorkelling is allowed in designated areas and visitors are only permitted on one section of Picard close to the Research Station. All visitors must be accompanied by SIF staff at all times when away from the vicinity of the station (including on all dives and snorkels) and strict regulations must be adhered to. Visits to the Frigate bird colonies, a major tourist attraction, are only allowed at one colony. No fishing or motorized water sports are permitted in the reserve.

32. Jurisdiction:

Government; managed and administered by the Seychelles Islands Foundation.

33. Management authority:

Seychelles Island Foundation (CEO: Dr Frauke Fleischer-Dogley)

P O Box 853

Victoria, Mahé, Seychelles

Phone: + 248 321 735 Fax: +248 324 884

Email: sif@seychelles.sc

34. Bibliographical references*:

Owing to the long standing research station on Aldabra and its popularity as research destination, there is a wealth of published and unpublished research on the ecology of the Atoll. For the sake of brevity, we have only listed directly relevant references here.

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Please return to: **Ramsar Convention Secretariat, Rue Mauverney 28, CH-1196 Gland, Switzerland**

Telephone: +41 22 999 0170 • Fax: +41 22 999 0169 • e-mail: ramsar@ramsar.org