Aldabra Atoll

2020 Conservation Outlook Assessment

SITE INFORMATION

Country: Seychelles
Inscribed in: 1982
Criteria: (vii) (ix) (x)

The atoll is comprised of four large coral islands which enclose a shallow lagoon; the group of islands is itself surrounded by a coral reef. Due to difficulties of access and the atoll's isolation, Aldabra has been protected from human influence and thus retains some 152,000 giant tortoises, the world's largest population of this reptile. © UNESCO

SUMMARY

2020 Conservation Outlook

Finalised on 01 Dec 2020

GOOD WITH SOME CONCERNS

Aldabra Atoll is one of the most undisturbed island ecosystems in the world, home to several unique species whose populations thrive in this remote location. The threat posed by the many of the most concerning invasive animal species have been eliminated, and the removal of the main invasive plant species has nearly been completed. Plans are in place to control / eradicate the rats and cats, and a comprehensive biosecurity plan has been prepared to limit new introductions. High resolution maps of the atoll's marine and terrestrial habitats have been completed providing a solid baseline against which future changes in habitat status and extent can be detected. The long term monitoring programmes have been reinvigorated and new technologies adopted to streamline data collection and management processes. These smart technologies have reduced the overall costs of the monitoring programmes and increased the responsive capacity of managers. A new management plan and zoning plan has been prepared, which identifies key management strategies and actions. The proposed extension to Aldabra's marine boundary, which increases the size of the protected area to 2,559.019 km², has been approved with the MPA boundaries expanded under existing protected area legislation. The management team are now awaiting the preparation of the new national Protected Area Legislation to finalise these legal processes and gazette the new boundaries under the updated legislation. The results of the habitat mapping and monitoring programmes are showing that habitats and populations of many flagship species are stable or increasing. With the implementation of biosecurity measures to prevent further invasions, the management plan to guide and help prioritise actions, the conservation outlook for Aldabra Atoll is currently good with some concerns.

FULL ASSESSMENT

Description of values

Values

World Heritage values

▶ Geomorphology **Criterion:(vii)**

Aldabra Atoll is overall one of the largest coral atolls in the world (Hillary et al. 2002) and one of only two raised coral atolls worldwide to not be heavily impacted by human activities. 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 (World Heritage Committee, 2010). The lagoon contains many smaller islands and the entire atoll is surrounded by an outer fringing reef (World Heritage Committee, 2010). 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 (World Heritage Committee, 2010).

▶ Terrestrial vegetation **Criteria:(ix)(x)**

Aldabra is an outstanding example of an oceanic island ecosystem in which evolutionary processes are active within a rich biota (World Heritage Committee, 2010). Most of the land surface comprises ancient coral reef (~125,000 years old) which has been repeatedly raised above sea level (World Heritage Committee, 2010). The size and morphological diversity of the atoll has permitted the development of a variety of discrete insular communities with a high incidence of endemicity among the constituent species (World Heritage Committee, 2010). Aldabra houses at least one currently unique, but potentially formerly widespread, habitat type, the tortoise turf. These relatively highly diverse grass-dominated areas are likely to be maintained due to the heavy grazing pressure exerted by the giant tortoises (Merton et al., 1976). Terrestrial habitats and vegetation types, have been mapped in last 5 years using high resolution satellite imagery. The vegetation mapping has indicated no significant change in the area of Aldabra's terrestrial vegetation (Walton, 2015).

▶ Freshwater and brackish pools **Criteria:(ix)(x)**

There are 20 freshwater and brackish pools on the platin surface across the Atoll, which vary from shallow depressions holding water for only a few hours; a thin lens over saline pools; to pools that are permanent throughout the wet season (Cognan & Hutson 1971; SIF 2016). The largest pool is Bassin Flamant, which has a dry season diameter of about 300 m, but this and other pools increase in size during the wet season (Stoddart et al., 1971). The pools provide habitat for various algal species, crabs and fishes, and are an important source of food and water for tortoises, birds and land crabs. The recently completed habitat map includes freshwater pools as a habitat category which can be used for future monitoring (Walton, 2015). Endemic red shrimps, especially on Picard Island, are found in some of the pools.

▶ Sand beaches **Criteria:(ix)(x)**

There are 50 beaches along the outer coastline of Aldabra Atoll, predominantly on the sheltered north and south west coasts. There are also various smaller beaches within the lagoon, interspersed between the mangroves. Sandy beaches are important habitat as they provide nesting areas for green and hawksbill turtles (Mortimer et al., 2011). Sand beaches are currently in a good condition although there is some erosion occurring on parts of Aldabra's largest beach, accumulation of marine debris is substantial in all areas but particularly on the south/east coastline, but sand deposits occurring elsewhere. Coral mortality following bleaching events may contribute to beach erosion and beaches are also susceptible to changing sea levels. Recent habitat mapping will help to assess and quantify long-

term trends.

▶ Intertidal mudflats

Criteria:(ix)(x)

Extensive intertidal mudflats fringe the inner edges of the lagoon on Aldabra Atoll, which have been estimated to cover a total area of 12.6 km2 (Hamylton et al. 2012). These are in good condition and apparently stable, and the populations of wading birds that use this habitat are stable (SIF, unpublished data, 2016).

▶ Mangrove communities

Criteria:(ix)(x)

The edge of Aldabra's lagoon is lined with extensive mangrove forests composed of seven species (Macnae, 1971). A study showed that Aldabra's mangrove communities have been stable and even increased slightly in the last 15 years (Constance, 2016).

▶ Seagrass and macroalgal communities

Criteria:(ix)(x)

Aldabra Atoll hosts large seagrass meadows both inside the lagoon and around the atoll., with the most abundant beds being found off Picard Island. Seagrass beds are an important functional habitat, whose roots stabilise the sediments and the leaf blades help filter water by slowing water currents and encourgaing finer particulates to settle. Seagrasses are also important primary producers and critical feeding habitats for dugongs and turtles (Hamylton et al. 2012, Mortimer et al. 2011), as well as acting as nursery grounds for many species of juvenile fishes, and hunting grounds for adults. Seagrass beds appear to be stable (SIF marine monitoring programme, unpublished data, 2016).

▶ Coral communities

Criteria:(ix)(x)

Aldabra Atoll is characterised by a shallow lagoon (40 metres deep). The reef supports a high coral coverage and numbers of coral species, with an estimated of 118 species (SIF, 2016). During the first global coral bleaching event in 1997/1998, corals around Aldabra were subject to elevated seawater temperatures which resulted in coral mortality. During the third global coral bleaching event in 2015/2016, there was a 50% decline in hard and soft coral cover; the marine monitoring programme, which started in 2012 will continue to track the recovery of the reef after this event (SIF, unpublished data, 2017).

▶ Marine water quality

Criterion:(ix)

Due to the isolation of the island, there are few direct anthropogenic pressures affecting the quality of water. There is localised sewage leaching from the research base septic tank although this is low levels and believed to be insignificant (SIF, 2016). Marine water quality is believed to be stable (SIF, unpublished data, 2016).

▶ Aldabra giant tortoises

Criterion:(x)

Aldabra hosts the largest extant population of giant tortoises worldwide (~100,000 animals) (World Heritage Committee, 2010). Giant tortoises of many taxa were widespread, in high densities, on islands around the world until humans arrived and exterminated them – directly, or via introduced predators (Hansen et al., 2010). Aldabra remains one of only two places in the world where giant tortoises survive (the other being Galapagos, which currently hosts a much lower density of giant tortoises per km2) and the last remaining place among the Indian Ocean islands. The tortoise population is entirely self-sustaining: all the elements of its intricate interrelationship with the natural environment are evident (World Heritage Committee, 2010). Aldabra thus emerges as the last place in the world, where the evolutionary ecology of giant tortoise – plant interactions can be studied (World Heritage Committee, 2010). Long-term monitoring data indicate that the Aldabra giant tortoise population has remained stable over the past 15 years (Turnbull et al., 2015).

▶ Landbirds

Criterion:(x)

The property is a significant natural habitat for birds, with three endemic landbird species, including two extant species (Aldabra drongo and Aldabra fody) and one species presumed extinct (Aldabra Brush Warbler). The Aldabra fody was only recently confirmed as a separate species by SIF staff (Van de

Crommenacker et al. 2015a). There are another ten distinct subspecies of landbird, amongst which is the White-throated rail, the last remaining flightless bird of the western Indian Ocean. Long term monitoring of seven landbird species found populations to be either increasing (6 species) or stable (1 species, the Aldabra drongo) between 2002 and 2014, showing an overall stable trend (Van de Crommenacker 2015b). The Aldabra rail has expanded its re-introduced population size on Picard island to greater than the predicted carrying capacity on the island (Sur et al. 2013).

▶ Other terrestrial fauna **Criterion:(x)**

There is rich aquatic insect fauna on Aldabra Atoll in comparison with other island groups, due to the high variability in chemical and biological conditions of the freshwater pools (SIF 2016). There are 11 species of land crabs on Aldabra Island, including three types of hermit crabs (SIF 2016). Aldabra's coconut crab (Birgus latro) population has been monitored twice monthly since 2006 and although there are seasonal changes in abundance, the population is stable (SIF, pers. comm.). There are three known species of lizards on Aldabra Atoll; a skink (Cryptoblepharus boutonii), and two gecko species (Hemidactylus mercatorius, LC and Phelsuma abbotti LC), the latter being emdemic to the Aldabra Atoll. The population status is understood to be stable (SIF 2016). Bats are the only mammals native to Aldabra Atoll and there are four species, three of which are endemic to the atoll. There is no trend data is available for other terrestrial species (SIF, unpublished data, 2016).

▶ Sea and shorebirds **Criterion:(x)**

There are vast waterbird colonies including the second largest frigatebird colony in the world and one of the world's only two oceanic flamingo populations (World Heritage Committee, 2010). Aldabra also contains a population of the endangered Madagascar Pond-heron (Bunbury, 2014), which is in decline in most other parts of its range. Monitoring shows that population of seabirds are stable or increasing. The annual frigatebird census indicates stable or increasing numbers of both species (with substantial year-to year fluctuation) with 6,000 pairs of lesser frigatebird (Fregata ariel) and, 4,000 pairs of great frigatebird (Fregata minor) (Šúr et al. 2013a). Tropicbird nest monitoring shows no decline in numbers of nests in last 7 years although nesting success is among the lowest recorded for the species, surveys are needed for other species (e.g. red-footed boobies). Wading bird populations are seasonal but stable (SIF, unpublished data, 2016).

▶ Marine turtles **Criterion:(x)**

Aldabra is a highly significant breeding ground for green turtles (Chelonia mydas, EN) and it also hosts a small population of breeding hawksbill turtles (Eretmochelys imbricata, CR) (World Heritage Committee, 2010). The atoll is also an important feeding ground for both species and for occasional loggerhead turtle (Caretta caretta, VU), which occur in the area but do not breed on the atoll. Aldabra Atoll is the largest rookery in the western Indian Ocean for green turtles. Last published data to 2008 showed a 500-800% increase in nesting green turtles over a 40-year period (Mortimer et al. 2011). Numbers of green turtles have continued to increase at the same rate since then (SIF, unpublished data). While green turtles tend to nest on the sand beaches on the outer edges of the atoll, the critically endangered hawksbill turtles nest primarily on beaches inside the lagoon (SIF 2016).

▶ Marine mammals **Criterion:(x)**

Aldabra hosts various species of marine mammals at different times throughout the year, which include humpback whales and dugong. Aldabra's dugong population is the only one remaining in Seychelles, and one of the few remaining in the western Indian Ocean region. The dugong population appears to be larger than initially thought, with at least 14 individual animals counted in one partial survey of the lagoon (SIF, unpublished data, 2013). The increased frequency of sightings indicate that Aldabra's dugong population is increasing (SIF Newsletter August 2016). Furthermore, several observations of female dugongs with juveniles in Aldabra's lagoon suggest that the site plays an important regional role as a dugong breeding/nursery area (SIF Newsletter August 2016). Further research into the dugong of Aldabra is needed.

▶ Fishes **Criterion:(x)**

The coral reef surrounding Aldabra host a wealth of marine life with exceptionally high abundances of

reef associated fishes and pelagic species, including many threatened species of bony fishes and elasmobranchs. The marine monitoring programme, which started in 2012/2013 introduced the use of Baited Remote Underwater Videos (BRUVs). The BRUVs have since been used to record fish community composition and abundances around the atoll. The cameras have detected high abundances of threatened shark species, such as hammerheads, and giant groupers. Results of the monitoring programmes indicate that fish populations are exceptionally high in comparison to other locations within Seychelles and the wider region, and populations are increasing (SIF marine monitoring programme, unpublished data). This was also confirmed by National Geographic Pristine Seas team expedition in 2015, which estimated fish biomass in the near shore waters surrounding Aldabra to be 5 tonnes per hectare, more than ten times the fish biomass found in the Seychelles inner islands (Pristine Seas, 2015).

▶ **Marine invertebrates (other)** **Criterion:(x)**

The coral reef surrounding Aldabra host a wealth of marine life with high abundances of other types of marine invertebrates (e.g. echinoiderms, gastropods, crustaceans etc.). There is limited information available to date and further more in depth research is required.

Assessment information

Threats

Current Threats **High Threat**

Several of the invasive species that previously threatened Aldabra's unique flora and fauna have been eradicated in recent years. The feral goats were removed in 2012, two invasive bird species were eradicated in 2016 and the island is free from sisal, the main invasive plant species. The neighbouring island of Assumption was also declared free from the invasive bird species, reducing the likelihood of imminent reintroduction (although these two species are present on other islands in Seychelles). The remaining invasive mammal and plant species still pose a threat, particularly with regard to the rats, which are likely to be extremely difficult if not impossible to eradicate. Marine litter remains one of the main ongoing challenges, as it does with many locations. Marine litter is being addressed through regular cleanups on Aldabra's more accessible sand beaches and a project to remove large amounts of marine litter from some of the more remote areas of the atoll (University of Oxford, 2019). The rubbish accumulating on more remote inaccessible beaches remains a concern. Efforts to address the threat of illegal fishing will be assisted by the increase in the marine boundary and efforts of the coast guard. The results of terrestrial and marine monitoring programmes and analyses of archive datasets, such as seawater temperature and rainfall data, are revealing that changes have already occurred on the atoll. With the efforts that have been invested in tackling the invasive species and other threats climate related threats are becoming more prominent as the main threats to Aldabra's terrestrial and marine ecosystems and flora and fauna.

▶ **Invasive Non-Native/ Alien Species, Problematic Native Species** **High Threat**
Inside site, throughout(>50%)
Outside site
(Invasive mammal species)

Cats and rats are the two remaining invasive mammal species that currently pose the greatest threat to Aldabra after the feral goats were successfully eradicated in 2012 (Bunbury et al., 2018). Cats and rats are highly invasive species and problematic on tropical islands around the world. Research into rat abundances and impacts on Aldabra (Harper et al., 2015; Harper & Bunbury, 2015) found particularly high abundances of rats in the mangrove habitats, where they grow larger, survive for longer, have larger litters and longer breeding seasons compared to rats in other habitats (scrub and coastal habitats). Rats are having impacts on seabirds, landbirds, small reptiles, plants, invertebrates and turtle and tortoise nests through egg predation. Research into cats on Aldabra found that they are not particularly abundant but their main prey is turtle hatchlings, rats, small reptiles and invertebrates. The cats that are found on the largest island of Aldabra, Grand Terre, may be responsible for the absence of frigatebirds on that part of the atoll, and their presence prevents the reintroduction of Aldabra rails, which would improve the prospects for this species. The eradication of these two species remains a

priority (SIF, 2016). The results of the rat ecology research indicates that eradication will be particularly challenging due to the high abundance of this species in mangrove habitats. A comprehensive biosecurity plan for Aldabra has been developed and is being implemented, which includes a risk assessment, identification of invasive species pathways and a step-wise approach to implement effective biosecurity measures for Aldabra at all levels (SIF, 2014). Biosecurity measures will help support all ongoing eradication programmes and prevent other new species, such as the myna bird, yellow crazy ant, and African land snail, known to be invasive elsewhere in Seychelles, from being introduced to Aldabra.

▶ **Water Pollution, Household Sewage/ Urban Waste Water** — **Low Threat**

(Sewage and waste water) — Inside site, localised(<5%)

Due to the isolation of the atoll, there are few direct anthropogenic pressures affecting marine water quality. There is localised sewage leaching from the research base septic tank although this is low and believed to be insignificant (SIF, 2016). There is a risk that the amount of waste water being released into the marine environment from visiting boats may increase if more tourist boats were to visit the atoll but currently visitation levels are relatively low and the length of stay within the waters of the site is monitored and restricted.

▶ **Invasive Non-Native/ Alien Species** — **Low Threat**

(Invasive sponge) — Inside site, scattered(5-15%)

In 2012, during Aldabra's outer reef mapping project, an encrusting sponge identified as Terpios hoshinota was observed at high densities on the coral reefs around the atoll (R. Klaus, pers. obs). This sponge has caused massive and rapid coral mortality in other parts of the world. T. hoshinota grows rapidly and widely and can outcompete hard corals. It also releases compounds that are toxic to other reef organisms. Once the sponge has colonized an area of the reef it can last for over a decade, dominating the reef bottom and preventing the recruitment of juvenile corals. The cause of these 'outbreaks' is still unknown, although pollution, coastal development and other human activities such as boats and shipping have been implicated. A monitoring programme for this species was started, and surveys are ongoing.

▶ **Tourism/ visitors/ recreation** — **Low Threat**

(Anchor damage) — Inside site, localised(<5%)

With the drop in piracy in the western Indian Ocean region over the past few years, it is possible that more tourist boats will want permission to visit Aldabra. Moorings have been installed in four locations in the protected area in the past (two in front of the field station, one in front of Passe Gionnet and one in front of the East Channel, Passe Houareau). If tourism demand increases in the protected area, there is a designated anchoring area in the vicinity of the field station, over a sandy rubble bottom, which should minimize impacts to coral (SIF, 2016).

▶ **Temperature extremes** — **Very High Threat**

(Coral bleaching and mortality) — Inside site, throughout(>50%)
Outside site

Aldabra was subject to coral bleaching during the first global mass coral bleaching event in 1997/1998 (Soutier et al., 2000; Stobart et al., 2005; Heron et al., 2017). The coral reefs within the property were also heavily impacted by the third global bleaching event from 2014 - 2017 (Cerutti et al., 2020). The marine monitoring programme on Aldabra detected changes in the status of the coral reef. The results of seawater temperature monitoring revealed that temperatures were higher than normal over the years leading up to 2016, during which there were excessively high temperatures that were sustained for several months. These conditions occurred during the third global mass coral bleaching event and resulted in bleaching and subsequent mortality around Aldabra. Seawater temperatures at 15m depth were above average for a long period of time, reaching a maximum of 36.2oC in April 2016, which is close to 5oC above the maximum temperatures recorded in other years. Between 69-99% of all coral colonies bleached in 2016 and coral cover declined by 50% between 2014 and 2016 (SIF Newsletter May, 2016). The highest overall coral cover remaining was ca. 23-28% at two sites within the lagoon. These sites also had the highest cover of coral recruits and the highest proportion of herbivores in

relation to total fish abundance on shallow surveys across all survey sites. In 2020, mean hard coral cover across all sites and depths continues to increase following the 2016 bleaching event with overall cover reaching 16.5% (± 1.39% SE), up from 14.3% in the previous season (SIF Season 7 Marine Monitoring Report). While the signs of recovery are promising, it will probably take between 5 to 10 years for hard coral cover to return to previous levels, and this assumes there are no further mass coral bleaching events in the intervening years.

▶ **Droughts** **Low Threat**

(Increased frequency of droughts)

Inside site, throughout(>50%)
Outside site

Aldabra's terrestrial vegetation is being impacted by changes in rainfall patterns and increased drought frequency, which could also pose a threat to the giant tortoise population (Haverkamp et al., 2017). Analysis of the long-term monthly rainfall data between 1969 and 2013 revealed that rainfall has declined and the average number of drought months per annum has increased three-fold, from an average of two to six drought month per annum. Open mixed scrub and grasslands, the preferred habitats of tortoises, showed the greatest variation in response between drought and non-drought months. In the short term, tortoises could be impacted by a reduction in the quality and quantity of food and shade available, and in the long term by changing habitat composition on the atoll (Haverkamp et al., 2017). A reduction in rainfall and increased droughts could also impact other types of vegetation such as the mangrove communities and other terrestrial fauna.

▶ **Invasive Non-Native/ Alien Species** **Low Threat**

(Invasive plant species)

Inside site, widespread(15-50%)
Outside site

There are several plant species on Aldabra that are known to be invasive, including: sisal (Agave sisalana), Casuarina (Casuarina equisetifolia), and herbs such as the Madagascar periwinkle (Catharanthus roseus) and the porterweed (Stachytarpheta jamaicensis). The latter two species are able to dominate low ground vegetation and are not grazed by tortoises. Casuarina is highly invasive in many places, and is believed to have been planted and now thought to be invading Ile Picard and Middle Camp on Ile Malabar. A sisal eradication programme was started in 2014 (SIF Newsletter November, 2014). The eradication programme started by testing different methods to kill these plants. The most effective method was to remove the central growth ring before applying a herbicide (van Dither, Bunbury & Kaiser-Bunbury, 2015). The largest and densest of the three stands treated was at Ile Michel, a small island inside the Aldabra lagoon, where 2500–3000 plants were treated. Aldabra has now been declared sisal free (Bunbury & van Dither, 2019). Further research is needed to assess the magnitude of impacts of the other introduced plant species, and decide on control/eradication efforts.

▶ **Solid Waste** **Low Threat**

(Marine litter)

Inside site, throughout(>50%)
Outside site

Aldabra is remote but the beaches are often inundated with marine litter, reflecting the increase in this problem within the region and at a global scale. Low lying parts of the coastline are affected by marine litter and other debris brought in by the tide (plastics, fishing nets, rope, buoys, glass bottles, flip flops, drinks cans etc.). The accumulation rate of litter arriving on different parts of the island varies depending on monsoon season. Regular clean-up activities are carried out on the sandy beaches around the atoll, particularly those visited as part of the regular turtle monitoring activities. Marine litter can however accumulate in other less frequently visited parts of the atoll, especially on Grande Terre, the south island. The trash poses a threat to wildlife that use the beaches (e.g. turtles, seabirds and waders), as they may consume or become entangled in the litter that washes up on the beaches. The litter can also spread inland and affect coastal grasslands, the favoured grazing areas for giant tortoises. Marine wildlife on the coral reef and in the pelagic zone are also at risk. Lost fishing gear, line and nets including the nets attached to drifting fish aggregating devices (FADS) for example, can become caught on the reef and cause breakages of the coral (pers. obs.). Fishes, turtles, and marine mammals may also be affected. There is also some potential for reduced coral health and increased disease through micro-plastics and leachate re-entering the marine system from coastal run-off and wave action. In 2019 SIF launched the Aldabra Clean-Up Project, combining an expedition to clean-up these remoter areas,

coupled with research and raising awareness of the issue. The clean-up removed 25 tonnes of marine plastic litter and estimated there is ca. 500 tonnes of litter remaining on Aldabra, the highest accumulation reported for any one island worldwide (Burt et al.In Press). Clearing the remaining accumulated litter would require substantial resources.

▶ **Hunting and trapping, Fishing / Harvesting Aquatic Resources**

(Illegal fishing)

Low Threat
Inside site, localised(<5%)
Outside site

No fishing is permitted around Aldabra apart from in the specified subsistence fishing zones, which can only be fished by SIF staff to feed the staff on the research base (SIF, 2016). Surveillance and enforcement of the marine environment of Aldabra is a challenge given the remote location and large area that needs to be patrolled and there have previously been reports of poaching. In 2015, staff based on the atoll reported the presence of two unidentified vessels in the waters around Aldabra, one August and another in October (SIF Newsletter October, 2015). On both occasions, the Seychelles Coastguard were asked to carry out additional air and sea patrols. The Seychelles Coastguard now has an almost permanent presence on the nearby island of Assumption that allows for a timely response to any illegal activities that are sighted in Aldabra's waters and an increased frequency of boat patrols, which assists in safeguarding Aldabra's pristine ecosystem from any illegal activities (SIF Newsletter October, 2015). Subsistence fishing for Aldabra residents was previously unrestricted although there was a risk that this could cause localised depletion of targeted fish (SIF, 2016). To address this subsistence fishing activities have since been restricted to specific zones around the atoll (SIF, 2016). Subsistence fishing activities are included as part of the regular monitoring programmes carried out by staff. Collection and entry of subsistence fishery data has recently been streamlined, using a custom built cybertracker application loaded onto a hand held Trimble GPS. The device allows data collectors to record the location where each individual fish is caught, along with other information, which are then easily downloaded and ready for analysis (SIF Newsletter July 2015). A new Fishing App has also been developed to allow for the instantaneous visualization of the collected data (SIF newsletter October, 2016). Illegal fishing activities remain a threat to the marine ecosystem and regular surveillance and enforcement patrols need to be maintained and eventually upgraded now the marine boundaries have been increased.

Potential Threats

High Threat

The risk of new and potentially invasive species being introduced to the atoll (e.g. crazy ants) is being addressed through the implementation of a biosecurity plan. The devastating impacts of climate change, particularly the impact of increased sea temperatures on the intensity and frequency of coral bleaching, are a stark reminder of the potential damage that could be caused in the future. Warming sea water temperatures, sea level rise, ocean acidification and severe storms could all cause serious damage to Aldabra and to the values for which it was inscribed. Further assessment of the potential impact of climate change on Aldabra's ecosystem and biodiversity, including modeling exercises to assess possible climate driven changes to habitats, as well as species focused predictions on the reproductive biology and demography (sex ratio) of sea turtles and giant tortoises for example, are needed as these may help anticipate additional management interventions to limit the impact of these changes.

▶ **Invasive Non-Native/ Alien Species**

(Invasive bird species)

Low Threat
Inside site, extent of threat not known
Outside site

Aldabra has now reclaimed the title as the largest tropical islands free from invasive birds (SIF Newsletter March, 2017; Bunbury et al., 2019). In 2012, two invasive alien bird species, the red-whiskered bulbul and Madagascar fody, were discovered on Takamaka, during the goat eradication campaign (Bunbury et al., 2013a; Bunbury et al., 2013b). These species posed a major threat to native bird populations through competition for food, disease transmission and hybridisation with endemic species (Roberts, 1988). Genetic research showed that the Madagascar fody (Foudia madagascariensis) had begun to hybridse with the Aldabra fody (Foudia eminentissima aldabrana). The eradication campaign took 3 years to complete, and was implemented at the same time as a campaign on the adjacent island of Assumption, which was suspected to be the original source of the invasive birds. As

Assumption is situated only 27 km from Aldabra, it was considered critical that both species were eliminated simultaneously from both islands in order to lessen the likelihood that Aldabra would be invaded again. After several follow up missions, Assumption was declared free from both invasive bird species in January 2017 and Aldabra was declared free from both species in March 2017 (SIF Newletter March, 2017; Bunbury et al., 2019). Both bird species are still present on other islands in the Seychelles so the risk of reintroduction remains, but it is now considered to be much lower than before.

▶ Temperature extremes

High Threat

(Temperature extremes)

Inside site, throughout(>50%)
Outside site

Changes in air and sea water temperatures may result in further changes in the terrestrial and marine ecosystems and associated flora and fauna. Climate-driven changes are already impacting the coral reef (Heron et al., 2017) and may impact vegetation ecology, with impacts that then cascade through the ecosystem (e.g. plant-animal interactions, such as herbivory, pollination, seed dispersal). The impacts of such changes are as yet unquantified on the flora and fauna of the property but are also likely to affect the reproductive biology and demography (sex ratio) of sea turtles and giant tortoises for example. Potentially also impacting activity patters of giant tortoises, an important island ecosystem engineer species (Falcon et al., 2017). While the threats posed by increasing temperatures are of even greater concern for sites that experience other human pressures this is also of concern for properties that experience minimal human pressures like Aldabra.

▶ Shipping Lanes

High Threat

(Chemical and oil spills and collisions)

Outside site

Aldabra atoll is situated very close to the major shipping lane along the east African coast, and there is a potential risk of collisions and oil or chemical spills. While the risk is small, the potential for damage is great. There is a 30 NM oil tanker avoidance area around Aldabra. A new lighthouse was installed on the atoll in 2012 to help mitigate the risk of collisions and spills. The extension to the boundary of the MPA could also be designated as an International Maritime Organisation Particularly Sensitive Sea Area.

▶ Habitat Shifting/ Alteration

High Threat

(Sea level rise)

Inside site, throughout(>50%)
Outside site

Sea level rise has the potential to directly impact the property and the values for which is was inscribed. A rise in the sea level could result in the loss of all low lying habitats around the atoll and this could result in a loss of critical habitats such as beaches, mudflats, mangroves, coastal grasslands, with implications for associated flora and fauna.

▶ Storms/Flooding

High Threat

(Cyclones and coastal flooding)

Inside site, throughout(>50%)
Outside site

Seychelles is situated outside the cyclone belt in the Indian Ocean. However, as the global climate continues to change, sea water temperatures continue to rise, weather patterns across the wider region are likely to become more unstable, and other climate hazards, such as cyclones, may also pose a threat. In April 2017, cyclone Fantala destroyed infrastructure and vegetation on the island of Farquhar. Fantala was the strongest cyclone on record in the south-west Indian Ocean, matched only by cyclone Agnielle in November 1995. The damage to Farquhar was a stark reminder of the vulnerability of Seychelles' outer islands. In 2016, a cyclone shelter was constructed on Aldabra to provide refuge to staff located on the island.

▶ Invasive Non-Native/ Alien Species

High Threat

(Introduction of non-native species)

Inside site, throughout(>50%)

The potential risk of marine or terrestrial invasive species being introduced to the atoll (e.g. crazy ants, African landsnail, myna) is being addressed through the implementation of a biosecurity plan that includes strict measures to prevent such introductions. Work is ongoing to fully implement the plan and

adapt efforts to changing conditions and any new threats identified.

▶ **Ocean acidification** **High Threat**

(Ocean acidification)

Inside site, throughout(>50%)
Outside site

Marine organisms are highly susceptible to changes in ocean chemistry. The ocean currently absorbs approximately half of the CO2 produced by burning fossil fuel. When CO2 dissolves in seawater it forms carbonic acid, and as more CO2 is taken up by the ocean, the pH decreases becoming more acidic. Ocean pH has already decreased by about 30%; by 2100 it is predicted that ocean acidity will increase by about 150%. Such a monumental shift in basic ocean chemistry will have implications for ocean life, especially for those organisms that require calcium carbonate to build shells or skeletons. Ocean acidification thus poses a potentially high threat to many forms of marine life.

Overall assessment of threats

High Threat

The list of current and potential threats to the property is considerable, although many of the identified threats originate from outside the property and in many cases are beyond the control of management. Considerable effort continues to be invested in tackling some of the more manageable threats to the values of the atoll (e.g. invasive species). Mitigation measures are being enacted (e.g. biosecurity plan, expansion of the marine boundaries) for many of the identified threats. Current and future potential climate variability and severe weather events are one of the biggest threats to the atoll's ecosystem, species and World Heritage values alongside ever increasing amounts of marine litter. The analyses of long term rainfall patterns along with data on sea and air temperatures are showing that changes have already occurred and the marine environment has already been impacted by bleaching events. Further modeling work is needed to help better predict the potential impacts of climate change on habitats and species.

Protection and management

Assessing Protection and Management

▶ **Management system** **Highly Effective**

The original management plan (Beaver and Gerlach, 1998) has been replaced by an updated management plan (SIF, 2016). The current plan provides site managers with clear guidance on the key management strategies and identifies the priority actions needed to effectively manage and maintain values. Since finalizing the current management plan the marine protected area around Aldabra has been expanded (Ernesta, 2018; TNC, 2020). The property has also taken part in Management Effectiveness projects used MEE tools to develop and refine management processes (UNESCO, 2007).

▶ **Effectiveness of management system** **Highly Effective**

The property is managed by the Seychelles Island Foundation, which has a permanent office on Mahe. The manned research station on Aldabra ensures timely implementation of all monitoring and management decisions (SIF, 2016). Management of the property is complicated given its isolation and the distance from the main Island of the Seychelles but the presence of permanent staff dedicated to management of the property helps address these challenges. The management framework for the property includes statutory considerations including the development of a management plan, protected area boundary, a suitable zoning scheme, appropriate regulations and policies, as well as human and financial resources (SIF, 2016). Management effectiveness assessments have been completed for Aldabra as these are a requirement of a GEF (Global Environment Facility) funded project.

▶ Boundaries

Highly Effective

The whole of Aldabra atoll is included within the boundary of the site, and the marine boundary extends from the mean high water mark to 1km offshore. An extension to the size of the protected area saw the marine protected area boundary extend to the approximate 3km depth contour line and increase the size of the protected area to 2,559.019 km². The proposed boundary extension for the MPA was approved by Cabinet and gazetted in December 2018 under the National Parks and Conservancy Act 1969.

▶ Integration into regional and national planning systems

Highly Effective

SIF, as the organisation responsible for the managerment of Aldabra, is an active partner in several national and regional planning programmes. SIF were active participants in the UNDP/GEF funded Protected Areas through NGO Modalities project. One component of that project explored the potential to expand the terrestrial and marine protected area boundaries to meet with CBD targets and the Seychelles government commitment to achieve 30% protection on land and in the sea. SIF has also been actively participating in the follow on project, which started as a UNDP/GEF initiative and is now a TNC led project to develop a Marine Spatial Plan for the Seychelles entire Exclusive Economic Zone (EEZ).

▶ Relationships with local people

Highly Effective

Seychelles Islands Foundation (SIF) runs various activities throughout the year to engage and inform Seychellois about Aldabra and the other World Heritage Property managed by the organisation, the Vallee de Mai. SIF produces a monthly newsletter, runs a website, facebook page, and twitter account. The outreach activities also includes a school competition, the winners visiting Aldabra. SIF was also planning to construct a building on Mahé, called Aldabra House. The building would have served as the SIF headquarters and as a visitor attraction featuring outdoor and indoor exhibits, displays and activities designed to recreate the magic of Aldabra (SIF, 2016). Unfortunately the organisation was forced to cancel the project after the plot of land that was designated for Aldabra House fell under an area undergoing extremely dense infrastructure development (Karapetyan, 2019).

▶ Legal framework

Mostly Effective

The Aldabra Atoll Special Reserve was declared under the National Parks and Nature Conservancy Act (1969). A review of the protected areas legislation resulted in the preparation of the Seychelles Protected Area Policy (2013), which stated that the current suite of legislation and regulations that directly or indirectly apply to protected area management are mostly out of date, incomplete and sometimes contradictory. This has led to a process to update this legislation. At the time of writing this process had reached the stage of a white paper with the Act being renamed the Nature Reserves and Conservancy Bill. In March 2020 the Seychelles Government announced an expansion of the marine protected area around Aldabra including a High Biodiversity Protection Area which has been gazetted under the original 1969 Act.

▶ Law enforcement

Mostly Effective

SIF have long partnered with the Seychelles Coast Guard, in particular to address issues around piracy in the waters around Aldabra. This partnership has included periods with coast guard staff based on Aldabra on a full time basis as needed. There is an almost full time Coast Guard presence on the nearby island of Assumption, which has improved the ability to respond quickly to potential illegal activity in the area and increased the number of surveillance patrols. The expansion of the MPA boundary and designation of a High Biodiversity Protection Area will also provide clarity in terms of allowable activities and remove any ambiguity regarding where activities can occur.

▶ Implementation of Committee decisions and recommendations

Data Deficient

There is very little data to assess the implementation of committee decisions in regard to the property. A retrospective Statement of Outstanding Universal Value was agreed at the request of the committee

and the only other decision relevant to the property was in reference to a boundary clarification. This request was responded to quickly and appropriately.

▶ Sustainable use — Mostly Effective

Subsistence fishing for Aldabra residents could easily cause localised depletion of targeted fish even though the numbers of staff based on the island is low (SIF, 2016). Fishing activities have now been restricted to specific zones around the atoll (SIF, 2016). The fishing activities are monitored by staff to help ensure that localised depletion does not occur. Collection and entry of subsistence fishery data has also recently been streamlined to enable site managers to respond more quickly to any concerns.

▶ Sustainable finance — Some Concern

Aldabra is situated 1000km from the inner islands of the Seychelles and basic operational costs (e.g. transferring staff, equipment and supplies) are therefore very high. Aldabra is part-financed by entrance fees for the SIF-managed UNESCO World Heritage site Vallée de Mai on Praslin and by external project funding. While the Vallée de Mai generates a substantial and fairly consistent income stream, project funding is much less predictable. As previously reported in Outlook Assessments, the current funding situation for Aldabra is adequate, but vulnerable. Funding is at least in part dependent on the number of international tourists visiting the Seychelles and the Vallée de Mai. An economic recession or adverse events that affect the Vallée de Mai (e.g. a fire or the COVID-19 outbreak) could jeopardize this source of income. The installation of a decentralized photo-voltaic system in 2012, in combination with a switch to energy-efficient appliances and a revised environmental management protocol, substantially reduced operational costs as the permanent research station is now 97% self-sufficient in its energy requirements (Quartz, Bunbury & Fleisher-Dogley, 2013; SIF, 2019a). SIF has also prepared a sustainable financing plan as part of the management planning process (SIF, 2016). One of the potential funding sources identified was Aldabra House, the visitor centre that SIF had planned to construct on Mahé. Unfortunately this project was canceled due to impacts from high density development around the land earmarked for the centre. Another possible source of funding is landing fees for tourists to the atoll, as the alleviation of the threat from piracy is likely to mean more tourists will want to visit the island. However, any increase in tourism comes with other impacts on the property.

▶ Staff capacity, training, and development — Mostly Effective

Staff facilities on Aldabra are excellent and even though the site is remote SIF makes every effort to provide training, led by experts in the field or by the scientific coordinator. For example, staff have been encouraged to participate in Massive Online Open Courses (MOOC's) including a course on biodiversity and climate change from the University of Zurich, providing university level information and mentorship by top level scientists. This is complimented by on-site training by Aldabra's Scientific coordinator. Staff members are encouraged to make presentations to other staff on topics of their choice, building their confidence in public speaking and expanding everyone's knowledge on the selected topics. One of the main problems that SIF encounters is that given the remote location of the atoll it can sometimes be difficult to retain staff. Although not ideal, establishing a rolling system of staff training is one way to address this issue and providing access to training courses when staff are back on Mahe would also assist. SIF have developed extensive and detailed protocols, along with training videos to ensure high quality and consistency in all aspects of the science programme. Recent database development, maintenance and data analysis frameworks has led to increased real-time data analysis on site.

▶ Education and interpretation programs — Highly Effective

SIF has dedicated outreach staff that ensure a high visibility of Aldabra in the Seychelles' society and beyond. The Visitor's Centre at Vallée de Mai has improved people's knowledge of the management link mentioned above. Since 2012, SIF has launched a monthly e-newsletter, a popular Facebook profile and a Twitter page, in addition to regular newspaper and magazine articles. All of these forums have helped to increase the visibility of Aldabra. In addition to this SIF runs a regular schools competition the winner of which gets to visit Aldabra. SIF had also developed plans for a large visitor centre on Mahe - Aldabra House. These plans were cancelled in 2019 due to infrastructure pressures on the land earmarked for

the centre.

▶ Tourism and visitation management

Mostly Effective

Aldabra Atoll has huge potential as an ecotourism destination. The designation of the Atoll as a World Heritage Area has further enhanced the protected area's marketability. Tourism on Aldabra is restricted to day-time visitors from boats mooring outside the reef of the research station and there are strict visitor protocols. When visiting the protected area, tourists can participate in wildlife viewing, snorkelling and SCUBA diving but must be accompanied and supervised by a staff member. The remoteness of the Atoll and the cost to get there have been the main factors limiting tourism development, as well as the threat of piracy between 2009 and 2013. With the piracy under better control, there is the potential for tourism to increase and expand, but with any increase in visitation and numbers comes increased potential for introducing other threats, such as increased damage to the coral reefs through indiscriminate anchoring, disturbance of the terrestrial flora and fauna, fishing, and the introduction of non-native species. The management plan provides guidance for site managers on how to mitigate these issues and ensure that site values are maintained (e.g. protocols for marine ecotourism). The Aldabra zoning plan restricts tourism activities to a very small area of the atoll, there is one anchoring location over sand so no damage to coral reefs should take place. Sensitive frigatebird colonies are now fully-protected and there are strict rules for zodiacs inside the lagoon. The new biosecurity measures now implemented for all tourist vessels are stringent, with a biosecurity briefing to all passengers provided by SIF staff, plus a biosecurity video (https://www.youtube.com/watch?v=VzOg7LJJBGo), followed by cleaning of shoes, bags and clothes and checks to all personnel and items going ashore.

▶ Monitoring

Mostly Effective

Terrestrial and marine monitoring programmes are carried out according to annual workplans and undertaken by staff based at the research station. Monitoring programmes cover key species, habitats and ecological processes on the land (e.g. flowering plant phenology, landbird and seabird nesting success) and in the sea (e.g. water quality, coral reef and associated fish species), as well as management-specific monitoring (e.g. invasive species). The long-term species monitoring programmes have been revised to ensure that they can accurately detect changes to the values of the site and address key management focused questions. The aim of the revision was to shift monitoring towards a more adaptive and responsive approach. This transition has been achieved through using new technologies, including the use of hand-held smart GPS devices with customized software (e.g. cybertracker) and applications for data visualization. These technologies are improving the ease of data management, as they streamline data collection and entry.

▶ Research

Highly Effective

SIF have long-term established collaborations with world-class research institutions on several aspects of the property and its values. These collaborations have been productive both in terms of informing management but also peer reviewed articles.

Overall assessment of protection and management

Highly Effective

SIF's management of Aldabra is extremely professional. Despite the atoll's remote location the site is well protected, legally and in practice. Protection of the marine areas around the atoll has improved in recent years including efforts to expand the marine protected area and partnerships with the Seychelles Coast Guard to address illegal activities within the waters of the property. In addition to this: monitoring programmes have been revised and new technologies introduced to allow site managers to track progress and respond more quickly to any new concerns as they emerge. A biosecurity plan and an up to date management plan, which includes a sustainable financing plan is in place. These documents provide the updated guidance needed to help SIF prioritize their activities to manage site values and ensure their conservation. The successful management of the property was acknowledged in 2019 when Aldabra was recognised as an outstanding marine protected area with a

Blue Park designation by the Marine Conservation Institute (SIF Newsletter October, 2019).

▶ **Assessment of the effectiveness of protection and management in addressing threats outside the site** **Data Deficient**

The majority of threats to the property from outside the site are beyond the control of management of the site e.g. climate change, ocean pollution and as such there is little information available on the effectiveness of attempts to address these threats. Management of the property has undergone effectiveness assessments and the efforts to eradicate invasive bird species from the nearest neighbouring island of Assumption in order to prevent re-invasion of Aldabra are examples of the effective protection and management of threats outside the property. In 2019 SIF launched the Aldabra Clean-Up Project to shine a light on the issue of marine plastic pollution to the atoll, this project led to international news coverage (Sky News, 2019) and prompted increased attention of the issues from government, who then acceded to Annex 5 of the MARPOL Convention (Seychelles News Agency, 2019).

▶ **Best practice examples**

The effective eradication of invasive alien species from Aldabra and the nearest neighbouring island of Assumption is an example of best practice. The efforts put into habitat mapping and the upgrading of the monitoring programmes, particularly the use of new technologies to streamline data management process are another example of best practice along side overall management of a property that is isolated and as a result presents complicated logistical and financial challenges.

State and trend of values

Assessing the current state and trend of values

World Heritage values

▶ **Geomorphology** **Good**
Trend:Stable

Terrestrial (including categories for limestone areas, beaches, and freshwater pools), lagoon and forereef habitats (Hamylton et. al., 2018; Hagan et al., 2018) mapped in last 5 years. These maps can be used to assess, e.g. seabed disturbance, land degradation, coastal erosion.

▶ **Terrestrial vegetation** **Low Concern**
Trend:Stable

Vegetation mapping has indicated no significant change in the area of Aldabra's terrestrial vegetation (Walton, 2015). There are still some invasive species present although intensive efforts have seen the previously most predominant invasive species, sisal, eradicated from the atoll (Bunbury & van Dither, 2019).

▶ **Freshwater and brackish pools** **Low Concern**
Trend:Data Deficient

No trend data available but habitat map recently completed which includes freshwater pools as a category and can be used for future comparisons. Changes in rainfall and periods of drought may impact on these pools in the future.

▶ **Sand beaches** **Low Concern**
Trend:Deteriorating

Sand beaches are impacted by marine litter and there is some evidence of erosion. Although erosion and accretion is part a natural process, this may increase with climate change and changes in weather patterns. Coral mortality following bleaching events may contribute to beach erosion and beaches are

also susceptible to changing sea levels. Recent habitat mapping will help to assess and quantify long-term trends.

▶ **Intertidal mudflats**

Good
Trend:Stable

In good condition and apparently stable: habitat map recently completed which can be used for future comparisons; populations of wading birds that use this habitat are stable (SIF, unpublished data, 2016)

▶ **Mangrove communities**

Good
Trend:Stable

A 2016 study showed that Aldabra's mangrove communities have been stable and even increased slightly in the last 15 years (Constance, 2016).

▶ **Seagrass and macroalgal communities**

Good
Trend:Stable

Seagrass beds and macroalgal communities appear to be stable (SIF marine monitoring programme, unpublished data, 2016). There is seasonal variability which may need to be accounted for in the future.

▶ **Coral communities**

High Concern
Trend:Improving

The 2016 bleaching event caused a substantial and widespread decline in hard and soft coral cover and is now being monitored for recovery (SIF marine monitoring programme, unpublished data, 2017). Mean hard coral cover across all sites and depths continues to increase following the 2016 bleaching event (SIF, Unplublished data, 2020)

▶ **Marine water quality**

Low Concern
Trend:Stable

Marine monitoring programme indicates conditions are stable (SIF marine monitoring programme, unpublished data, 2016)

▶ **Aldabra giant tortoises**

Good
Trend:Stable

Long-term monitoring data published in 2015 show that Aldabra giant tortoise populations in the last 15 years are highly stable (Turnbull et al., 2015)

▶ **Landbirds**

Good
Trend:Improving

A paper published in 2015 by SIF staff showed that most endemic/native landbird species and sub-species are increasing in abundance, with one species (the Aldabra drongo) showing a stable trend (van de Crommenacker et al., 2015a). The Aldabra rail has expanded its re-introduced population size on Picard island to greater than the predicted carrying capacity on the island (Sur, van de Crommenacker and Bunbury, 2013). Genetic research has confirmed the Aldabra fody as a distinct species (van de Crommenacker et al., 2015b)

▶ **Other terrestrial fauna**

Data Deficient
Trend:Data Deficient

Aldabra's coconut crab Birgus latro population is stable but no trend data is available for other terrestrial invertebrate species including insects, molluscs, and crustaceans (SIF, unpublished data, 2016)

▶ **Sea and shorebirds**

Good
Trend:Improving

Annual frigatebird census indicates stable or increasing numbers of both species (with substantial year-to year fluctuation); tropicbird nest monitoring shows no decline in numbers of nests in last 7 years although nesting success is among the lowest recorded for the species, surveys needed for other

species (e.g. red-footed boobies). Wading bird populations are seasonal but stable (SIF, unpublished data, 2016).

▶ **Marine turtles** — **Good** / **Trend:Improving**

Last published data to 2008 showed a 500-800% increase in nesting green turtles over a 40-year period (Mortimer et al., 2011). Numbers of turtles have continued to increase at the same rate since then (SIF, unpublished data)

▶ **Marine mammals** — **Low Concern** / **Trend:Improving**

Aldabra's dugong population (the only one remaining in Seychelles) appears to be larger than initially thought, with at least 14 individual animals counted in one partial survey of the lagoon (Hamylton, Hagan and Doak, 2012; SIF, unpublished data, 2013). Efforts to estimate the size of the dugong population are ongoing along with surveys of other marine mammal species that utilize the waters of Aldabra (Appoo et al., 2019). The importance of the area for marine mammals was recognised with Aldabra being listed as an Important Marine Mammal Area (IMMA) in December 2019 (SIF, 2020).

▶ **Fishes** — **Good** / **Trend:Improving**

Results of the marine monitoring programme indicate that fish abundances are increasing (SIF marine monitoring programme, unpublished data)

▶ **Marine invertebrates (other)** — **Data Deficient** / **Trend:Data Deficient**

Marine monitoring programmes and biodiversity survey needed to increase knowledge of other marine invertebrates.

Summary of the Values

▶ **Assessment of the current state and trend of World Heritage values** — **Low Concern** / **Trend: Stable**

The terrestrial and marine monitoring programmes are showing that most habitats and species are generally in a good condition, and that populations of endemic or threatened species are either stable or improving. While the ecological integrity of the whole site is good and appears to be stable, there are differences in current state and trend of marine and terrestrial components of the site. The invasive mammals continue to pose the greatest threat to the status of terrestrial fauna. The high sea water temperatures and coral bleaching and mortality that happened in the past few years, have degraded the condition of the coral reef. Aldabra's coral reef is recovering from this event quicker than in other areas that are subject to other pressures (e.g. overfishing and pollution). Climate variability and change currently pose the greatest threat to marine ecosystems and the frequency of similar coral bleaching events is likely to increase in future years.

Additional information

Benefits

Understanding Benefits

▶ **Importance for research**

Aldabra provides a near-natural coral atoll laboratory, where terrestrial and marine components of atoll ecosystems and associated biodiversity can be studied in the absence of many of the factors that can so

often otherwise obscure long term ecological trends (e.g. coastal development and other human uses, as well as pollution, etc). The protection of Aldabra has already provided significant benefits in terms of furthering knowledge related to the management of endemic species and research into the methods to control invasive species. Knowledge gained from existing programmes and the lessons learnt can be used to inform conservation, rehabilitation and restoration efforts on other islands and atolls around the world. The turtle monitoring programme, along with monitoring of other marine species, is contributing to regional knowledge of species movements and conservation (Sanchez et al., 2020). Aldabra could further expand this globally important role by developing programmes to detect changes in the marine and terrestrial island ecosystems that may already be happening in relation to climate change.

Factors negatively affecting provision of this benefit :

- Climate change : Impact level - High, Trend - Increasing
- Pollution : Impact level - Low, Trend - Continuing
- Overexploitation : Impact level - Low, Trend - Continuing
- Invasive species : Impact level - High, Trend - Decreasing
- Habitat change : Impact level - Low, Trend - Continuing

Summary of benefits

Aldabra is a near-natural atoll laboratory, where research into and monitoring of the terrestrial and marine components can be conducted in the absence of many of the common pressures found elsewhere that can otherwise obscure long term ecological trends. The management of Aldabra provides an excellent case study in itself, particular the monitoring programmes, which were recently redesigned to provided managers with the information needed to allow them to respond should circumstances change. These programmes enable adaptive and responsive management, which is particularly critical in a remote location like Aldabra, but are also directly relevant for other protected areas globally.

Projects

Compilation of active conservation projects

№	Organization	Brief description of Active Projects	Website
1	Seychelles Islands Foundation	Indian Ocean Commission and European Union funded project to improve biosecurity measures for Aldabra, entitled, ‘Institutionalisation and implementation of biosecurity measures to ensure sustainable conservation management of biodiversity on Aldabra Atoll’.	http://sif.sc/major-projects www.sif.sc
2	Zurich-Aldabra Research Platform (University of Zürich, SIF)	Research on terrestrial ecology; focus on interplay between giant tortoises, vegetation and climate, movement ecology of giant tortoises.	http://www.ieu.uzh.ch/research/zarp.html
3	Oxford University and SIF - Aldabra Clean-up Project	Aldabra clean-up project, launched in 2018 and concluded in 2019. Results from the project will be included in a PhD thesis at Oxford by April Burt. Partners hope this project will lead to an even bigger clean up initiative. The focus of the project was to remove marine litter from remote locations on the Atoll. Funding sources were diverse, including crowd-funding, SIF support and private sources.	https://aldabracleanupproject.wordpress.com/ https://www.queens.ox.ac.uk/news/aldabra-clean-project-gets-underway

№	Organization	Brief description of Active Projects	Website
4	Seychelles Islands Foundation (SIF)	Aldabra House on of the biggest projects instigated in recent years this work would have established a visitor and education centre on Mahe to enable more people to experience and learn about Aldabra. The project was unfortunately cancelled in 2019 due to concentrated infrastructure development in the area of the land earmarked for the project.	http://sif.sc/news/2019/07/sif-cancels-aldabra-house-project-great-regret http://www.seychellesnewsagency.com/articles/11420/Project+to+show+realities+of+Seychelles%27+faraway+Aldabra+Atoll+is+cancelled+due+to+road+plan

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