ANNUAL REPORT 2017

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Message from SIF's CEO

Dear friends and followers

As you are already aware, Seychelles' World Heritage Sites are of outstanding universal beauty and as such the Vallée de Mai is the most visited natural site in the country. Aldabra Atoll is without exaggeration, one of the most desired places to visit by Seychellois and others around the world. Therefore, it was to our delight and honour, that both sites were visited in 2017 by our Patron President Danny Faure. Furthermore, it was a first that members of the National Assembly and specifically of the Islands Committee, paid an official familiarisation visit to Aldabra Atoll and its research station.

It is my firm belief that sharing our admiration and appreciation of the natural world is a primary driver to ensuring its protection. These visits have enabled SIF to improve its engagement with government, the legislative and the civil society. This engagement brings the efforts of SIF into the spotlight and gives the organisation higher prominence.

This year we also launched our new website as a way of sharing our United Nations Educational, Scientific and Cultural Organisation (UNESCO) sites with a wider audience around the world. It was a long journey to reach the finished product, but it was well worth it, to achieve the right design to engage as many people as possible.

2017 was also the first year that SIF was invited at global level to highlight the importance of the protection of our oceans. Three youth, all of them eco-warriors, who experienced Aldabra Atoll under the SIF sponsored Eco-School programme, became ambassadors of the atoll and pledged on behalf of the world youth for the protection of our oceans at the United Nations (UN) headquarters in New York, US.

Besides these exciting highlights the SIF team has more than ever put monitoring and science at the core of our activities and by doing so, detected the rapid invasion of the Vallée de Mai by yellow crazy ants. The seriousness of the situation left the board of trustees with no choice but to declare a state of emergency and allocate SCR 200,000 out of SIF's own funds to combat the invasion by researching best practices of successful eradication and control programmes around the world. 2017 was another year in which the dynamic and committed SIF team has stepped out of their comfort zone to ensure that Seychelles' World Heritage Sites are as protected and cherished as they deserve.

Dr Frauke Fleischer-Dogley, CEO

Highlights of 2017

This is a brief summary of SIF's milestones and achievements during this year. More details can be found in the report:

The Indian Ocean Commission and European Union (EU) are funding a biosecurity project to prevent future invasive species introductions to Aldabra.

A research and management symposium was held on Aldabra for the research and logistics teams to present a summary of their work.

The Aldabra House project was presented to President Danny Faure and was well-received.

Aldabra's new cyclone shelter was completed.

The Vallée de Mai welcomed 121,482 visitors in 2017 and received another TripAdvisor Certificate of Excellence again for its consistently positive reviews and feedback.

New reptile and amphibian research started in the Vallée de Mai.

SIF's Director of Research and Conservation, Dr Nancy Bunbury, attended the Island Invasives Conference 2017 and presented the lessons learned from SIF's work on invasive bird eradications.

Introduced Madagascar fodies were declared successfully eradicated from Assomption and Aldabra. Aldabra reclaims its title as the largest tropical island free from introduced birds.

The EU funding a project to further manage and mitigate the impacts of invasive alien species in the Vallée de Mai.

A ring-necked parakeet was spotted on Mahé and culled at Morne Blanc in August.

President Danny Faure visited the Vallée de Mai and Aldabra.

The Islands Committee of the National Assembly visited Aldabra.

The 2016 Eco-schools award winners visited Aldabra.

Three Seychellois students represented Aldabra at the first ever UN Ocean Conference in the US.

SIF took part in the National Expo on Eve Island, Praslin.

The new SIF website was launched after years of planning and development. It is packed with information on SIF, Aldabra and the Vallée de Mai, and will allow viewers a far greater understanding of SIF as an organisation, the two outstanding sites and the work done to protect and preserve them.

Creole festival activities took place in October at the Vallée de Mai. These activities included traditional dance and song performances, sales of local snacks and drinks, exhibition of antique items, traditional games and a photo exhibition.

The International Union for Conservation of Nature World Heritage Outlook 2 report was published, and assessed the conservation outlook for both Aldabra and the Vallée de Mai as 'good with some concerns', the second most optimistic category.

Five scientific peer-reviewed papers were published on the Vallée de Mai and Aldabra.

Staff changes and new positions

Science and Projects Coordinator

Annabelle Constance started working with SIF in 2011 and has been closely affiliated with the Foundation since. She recently completed her MSc in Environmental Science at the University of Zurich and in 2016 completed her MSc research on mangroves on Aldabra. Since returning to Seychelles she has been promoted to the role of Science and Projects Coordinator in which she facilitates and oversees some of SIF's major projects as well as research programmes at both sites. As part of her work, Annabelle hopes to operationalise the biosecurity plan for Aldabra and in the process preserve the ecological integrity of one of the most undisturbed ecosystems in the world.

Assistant Administrative and Accounts Officer

Elsa Lesperance joined the SIF team in August 2017 as the Assistant Administrative and Account Officer. She trained in basic accounting at Computing and Additional Learning and, prior to joining the Vallée de Mai team, she worked for three years as a bank clerk. Her role is to manage the cash transactions in the Vallée de Mai, including working very closely with the accounts team at head office. Elsa also handles staff issues and welfare at the Vallée de Mai and acts as the right hand of the Site Manager. Elsa has a passion for nature and loves working in the Vallée de Mai. As a Praslinoise she is happy to be contributing to the development of the UNESCO World Heritage Site!

Aldabra Scientific Coordinator

Cheryl Sanchez the Aldabra Scientific Coordinator following several years working in conservation management on tropical islands. In recent years, Cheryl has worked in senior roles in Seychelles on a variety of flora and fauna, both terrestrial and marine. Cheryl has an MSc in Biology from the University of Central Florida, with a strong background in sea turtle research, and is a certified bird ringer. She is responsible for managing the research team on Aldabra: maintaining high quality data collection and storage, collating the information into technical reports, and being the main contact point for researchers on Aldabra.

Inva'Ziles Project Coordinator

Sarah Atkinson joined SIF to coordinate the Inva'Ziles project specifically researching the impacts of and controlling a range of invasive alien species. Before this Sarah worked with the North Island myna eradication program in Seychelles and also has a wealth of experience from working in New Zealand and Scotland as a specialist in biosecurity and invasive species management. During her time at Vallée de Mai Sarah will be responsible for overseeing the rest of the Inva'Ziles team, working on projects to trial the restriction and control of rats around black parrot nests as well as wide-scale control of tenrecs and yellow crazy ants, using novel and innovative methods.

Assistant Aldabra Scientific Coordinator

Jennifer Appoo served as the Assistant Scientific Coordinator on Aldabra from April 2017. Prior to joining SIF she was the Project Manager for the Green Islands Foundation where she coordinated and assisted in several conservation projects encompassing protected area proclamation, invasive species control, community outreach and education. She is experienced in habitat, species and environmental monitoring. Jennifer holds an MSc degree in Marine and Coastal Zone Management from University of Montpellier and is passionate about marine biodiversity conservation.

Invasive Alien Species Project Officer

After obtaining her degree in environmental sciences at the University of Seychelles **Vicky Stravens** joined SIF in March 2015 as the Invasive Alien Species Project Officer for Praslin. She has now been promoted to Vallée de Mai Science Coordinator and now leads a dynamic research team, overseeing their work, conducting research and participating in the monitoring programmes such as those for coco de mer growth and regeneration, climate, black parrots, and phenology. Although taken on overarching coordinator role, Vicky's focus and passion for tackling invasive species is a key asset for the Vallée de Mai's overall objectives.

Visitor Centre Services Coordinator

Yanny Didon took on the role of the Visitor Centre Services Coordinator in 2017, after spending several years working as Accounts Technician at the SIF head office on Mahé and a year as Aldabra's Shopkeeper. During these previous not only gained insights into SIF's financial system and experienced beauty and challenges of working on Aldabra, but was also extremely supportive in the development of the Vallée de Mai's point of sales system. Having worked in all three locations, he gained invaluable experience which serves him well in this new position.

Project Officer

Jeremy Raguain first started working with SIF in 2013 as a Field Research Assistant on Aldabra. His experience of Aldabra's outstanding beauty and inspiring fauna heavily influenced his decision to pursue a general degree at the University of Cape Town, with Environmental Geographical Science and International Relations as his majors. After completing this degree and an Honours in International Relations Jeremy returned to Seychelles at end of 2017 to this position.

We also had a number of other staff who joined us or were promoted at:

Vallée de Mai

Netifa Esther joined us as a Sales Clerk at the Kokosye Café and Daniella (Mousbe) Florentine joined us as a Security Officer. Andrew Meriton joined us as a Field Worker and Yanny Didon joined the Vallée de Mai team as the Visitor Centre Services Coordinator, being promoted from Accounts Technician, based at head office. Stephanie Rose and Brina Zialor both joined as Visitor Attendants.

For the Inva'Ziles project we had Véronique Couttee joined us as the Inva'Ziles Project Officer, Júlia Kovács as the Black Parrot Data Officer and Sascha Dueker as the Black Parrot Volunteer.

Aldabra

Victoria Alis joined us as a Field Researcher Officer and Dominic Jean as a Trainee Ranger, with

Lorraine Cook and Jake Letori joining as Volunteers. Dr. Janske van de Crommenacker returned to Aldabra as a volunteer, to then become Aldabra's first Tourism Coordinator. Jean-Yves Payet joined us as a Cook with Trevor Henriette joining as a Junior Skipper.

Jeremy Waters also joined SIF as a volunteer for the ring-necked parakeet eradication project.

Staff education, training and events

Staff education

SIF continued to invest in their staff in 2017 by supporting them in further education, training and attending overseas events.

- Samia Auguste, the SIF Office Assistant, started a two-year course at the Guy Morel Institute in Human Resource Management. She is excited about the opportunities this course will offer and that it will enable her to grow in her role, developing in her position and her abilities in the field of Human Resources.

- Vicky Stravens, the Vallée de Mai Science Coordinator, became the third SIF staff member to complete the annual Durrell Endangered Species Management Graduate Certificate (DESMAN) Course at the Durrell Institute in Jersey, UK. In addition to the knowledge gained, Vicky also succeeded in securing a small equipment grant with funds to go towards sooglossid frog research in Vallée de Mai.

- Aldabra Skipper Joel Bonne obtained his certificate of competence for 60 nautical miles after attending courses at the Maritime Training Centre in personal survival techniques, personal safety and responsibility, fire fighting, and elementary first aid, and an exam in chart work.

- SIF held its first ever mist-netting and bird ringing training course in March 2017. A mixture of SIF staff were handpicked to attend the course which was led by Jerry Lewis and Ron Clevely. The British Trust for Ornithology bird ringing trainers came from the UK with over 70 years of experience between them. The SIF staff that attended the training were Terance Payet, Vicky Stravens, Cheyenne-Mae Chang-Yunn, Jessica Moumou, Julio Agricole, Jennifer Appoo, Ella Nancy, and Emmanuel Morel.

Staff training

When?	Who?	What?
May 2017	Annabelle Constance	Coastal Zone Monitoring and management, Mauritius
February - May 2017	Vicky Stravens	Durrell Endangered Species Management Graduate Certificate (DESMAN) at the Durrell Institute in Jersey, UK
February 2017 - present	Samia Auguste	Certificate in Human Resource Management (Guy Morel Institute, Seychelles)
March 2017	Terance Payet Vicky Stravens Cheyenne-Mae Chang-Yunn Jessica Moumou Julio Agricole Jennifer Apoo Ella Nancy Emmanuel Morel	Mist-netting/bird ringing, bird handling, Praslin, Seychelles
April/May 2017	Shanone Adeline	Coral Communities in Seychelles (Earthwatch, Seychelles)
June 2017	Ronny Rose Christina Quanz Annabelle Constance	Pest Abatement and biosecurity training, Seychelles
August 2017	Vicky Stravens	Systematic Adaptive Management
September 2015 - present	Jessica Moumou	BSc Environmental Science (University of Seychelles)
September 2017	Dylis Cedras Mary Hoareau	Business Plan Training for Protected Areas, Seychelles

Overseas events

When?	Who?	What?
March 2017	CEO	3rd Meeting of Signatories to the Dugong MOU and Seagrass + Technical workshop, Abu Dhabi
June 2017	Maria Brioche	Represented UNESCO at the UN World Oceans Day Conference, New York, USA
June 2017	CEO Christina Quanz	Aldabra House Project workshop, London, UK
July 2017	Director of Research and Conservation	Island Invasives 2017 conference, Dundee, Scotland
August 2017	CEO	COP12 Regional Preparatory workshop, Addis Ababa, Ethiopia
October 2017	CEO	Convention on Migratory Species COP12, Manila, Philippines
November 2017	CEO Christina Quanz	Aldabra House Project workshop, London, UK

Vallée de Mai management

In 2017, the Vallée de Mai once again welcomed over 100,000 visitors to the UNESCO World Heritage Site. The palm forest and SIF's world class visitor centre remain a highlight for visitors to Praslin. The Vallée de Mai was awarded a TripAdvisor Certificate of Excellence for the fourth consecutive year in 2017. The number of coco de mer nuts poached decreased to 45 nuts from 75 in 2016. The kernel export ban in 2012, increased monitoring and surveillance, and greater anti-poaching awareness have been key to the long-term downward trend in poaching.

TripAdvisor Certificate of Excellence

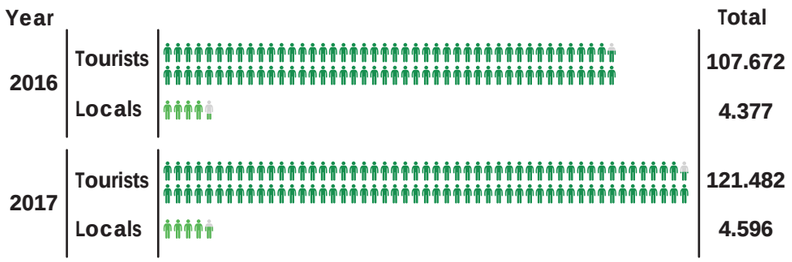
The Vallée de Mai was awarded a TripAdvisor Certificate of Excellence again in 2017. This was the fourth consecutive year that the Certificate of Excellence was received by the Vallée de Mai, and the fifth time since 2012. The Certificate of Excellence is based on the reviews made by visitors to the Vallée de Mai and it is an extreme vote of confidence to receive such consistently positive feedback from our guests.

2017
CERTIFICATE *of*
EXCELLENCE
tripadvisor

TripAdvisor is the world's largest travel review site, providing details on over 7 million accommodations, airlines, attractions and restaurants. The Certificate of Excellence takes into account the quality, quantity and recency of reviews submitted by travellers on TripAdvisor over a 12-month period. This certificate is a reflection of the excellent service and experience on offer at the Vallée de Mai, and the satisfaction of visitors.

Vallée de Mai tourism

The Vallée de Mai continues to be one of the foremost tourist attractions in Seychelles, with a total of 121,482 visitors in 2017, a 13% increase from 107,672 in 2016. A total of 116,886, the vast majority of visitors are tourists, and 33% of all tourists in Seychelles also visited the Vallée de Mai. In 2017, 4,596 Seychelles residents visited the Vallée de Mai, which represents a 5% increase since 2016 and over 5% of the total Seychelles population. Many of these visitors are school children, reflecting SIF's commitment to environmental education.

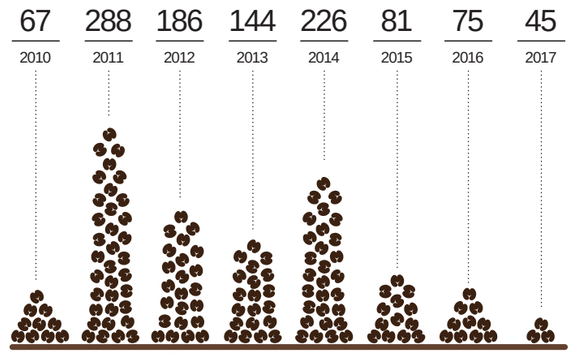


Number of tourist and local visitor to Vallée de Mai in 2016 and 2017

It is not just the superb primeval palm forest itself that has made the Vallée de Mai Seychelles' most visited natural site, but also the world class visitor centre. The visitor centre was completely rebuilt and since it opened it has hosted hundreds of thousands of local and international guests. The site's facilities include a cafeteria, lockers, souvenir shop, information desk and displays, toilets and a parking area. Thanks to the carefully designed centre and walking routes the UNESCO World Heritage Site is also partially wheelchair accessible.

Coco de mer statistics

The number of coco de mer nuts harvested in the Vallée de Mai for sale in 2017 was 381, slightly lower than the 393 nuts collected in 2016. Therefore more nuts have been left in the forest for regeneration and to protect the long-term health of the forest.



Total poached coco de mer nuts per year

The downward trend in poaching of coco de mer nuts continued in 2017 with 45 nuts poached during the year. This is an improvement on the 75 nuts poached in 2016, and is the lowest it has been in since monitoring of poaching began in 2010. These numbers are a far cry from the peak of the poaching crisis when 288 nuts were stolen in 2011, and the decrease over time can be attributed to the kernel export ban, increased monitoring and surveillance, and greater anti-poaching awareness.

Giant bronze gecko poaching

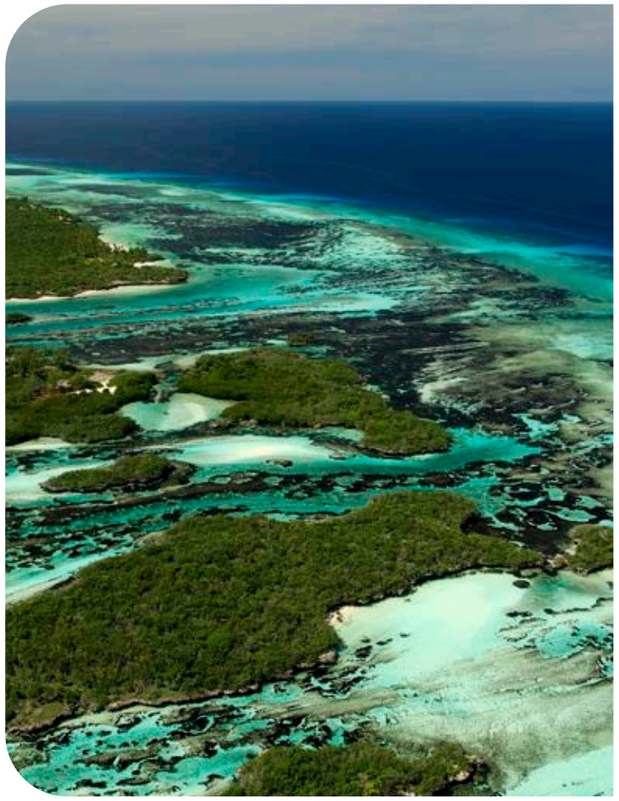
From late 2017 reports started to emerge that giant bronze geckos (*Ailuronyx trachygaster*) were being sold online and at reptile fairs in Europe. These geckos are not known to breed in captivity and it is almost certain that those individuals for sale were caught in the wild. The giant bronze gecko is endemic to Praslin and only occurs in mature coco de mer palm forest at low numbers, making it Seychelles' rarest reptile and extremely vulnerable to threats. The emerging risk of poaching therefore poses a significant new threat to the species.

Obtaining more information on the trade in giant bronze geckos and preventing their poaching from the Vallée de Mai will be high on the agenda for 2018. We will be taking steps to increase their local and international legal protection and will raise awareness of the issue. The global pet trade is one of the most pervasive threats to many species worldwide and urgent steps are needed to ensure that this does not become the case for the giant bronze gecko.

Aldabra management

2017 was another busy year for Aldabra's management with the large number of visitors to the atoll including VIP guests, researchers, tourists and construction workers. The SIF Annual General Meeting took place on Aldabra and the Aldabra symposium gave staff the opportunity to better understand the work done by their colleagues. The team celebrated the 5-year anniversary of the installation of the solar photovoltaic system, Aldabra's biggest infrastructural achievement to date, and continued to develop the research station to fit the needs of the thriving logistics and research teams. More tourists were welcomed to the atoll than any year since 2008, and the Aldabra House team moved closer to sharing the magic of Aldabra on Mahé.

In 2017 we implemented biosecurity measures on Aldabra to manage the pathways of people and supplies to the atoll and prevent invasive alien species arriving. We now have pest proof containers, training programmes for Mahé and Aldabra staff and biosecurity checks of all supplies and luggage going to Aldabra. We also have insect and rat control in Mahé storage places and on supply boats.



Aldabra House project moves forward

As Aldabra is in a remote location and is logistically and financially challenging to visit, SIF has been planning to create an Aldabra visitor centre on Mahé for several years. Called Aldabra House, the centre will give Seychellois and tourists a taste of Aldabra. During October 2017, the Aldabra House project was presented to President Faure and the cabinet, and has now been raised to a project of national importance. Following the project presentation to the cabinet, the project continued to progress throughout November with a geotechnical survey carried out on site in preparation for the planning application. A team of architects, structural and environmental engineers, and a cost consultant are working hard to ensure that all required preparations for the planning submission are completed by early 2018.

Meanwhile the exhibition space design has undergone some exciting developments; the available outdoor areas will now be included in the Aldabra experience. A two-day workshop was held with the exhibition designers in the UK, to discuss and develop the exhibition scheme design which culminated in a meeting with a company that develops state of the art virtual and augmented realities. Thrilling possibilities are being explored to include such stunning experiences into the Aldabra exhibition. With excellent support on all levels the project is finally making major long-desired progress!

SIF AGM on Aldabra

The 37th SIF Annual General Meeting (AGM) took place on Aldabra in 2017. Fourteen trustees of the SIF board, represented by local and international members, spent four days on Aldabra. For four of the newly appointed board members this was their first trip to Aldabra. The AGM is held on Aldabra every second year, allowing the trustees to deepen their understanding of the challenges and opportunities of managing one of the most remote UNESCO World Heritage sites in the world.

The meeting's agenda included the third concept of the Aldabra House project, which was presented by the architects. Other meeting topics included Aldabra's recently reviewed subsistence fishing protocol, which, for the first time, ensures that fishing activities are spatially restricted, in addition to the existing fishing ban in Aldabra's lagoon. Biosecurity was also a key topic since invasive alien species pose a major threat to this unique ecosystem. For the Vallée de Mai, the threat of increasing yellow crazy ants was discussed, which the board declared an emergency situation and requested immediate action. At the closure of the meeting the Aldabra Management Plan 2016–2026 was handed over to the Aldabra management team.

After the official part of the meeting, a trip to one of Aldabra's field camps Dune Jean-Louis, was organised where the board members engaged in beach cleaning. Marine debris is a serious problem affecting Aldabra. Around the southern coastline of the atoll tonnes of floating ocean debris have accumulated for decades. The beach clean-up stimulated a lot discussion and as a result, SIF is taking steps to raise awareness on the impact of marine debris on Aldabra and is in the process of developing a project to address the problem. The aim will be to remove years of accumulated marine debris from the atoll's coastlines and set up procedures that will allow staff to maintain regular debris removal.

Aldabra Symposium

In September 2017 a research and management symposium was held on Aldabra. The symposium was hosted by the Aldabra staff for the benefit of the staff themselves. Work on Aldabra is coordinated within two departments: the research team responsible for the implementation of the long-term monitoring programme and project work, and the logistic team responsible for all the operations on the atoll. Although the work of both teams is aimed at ensuring effective protection of Aldabra and closely linked and interdependent, the teams have different tasks. The symposium was therefore a perfect platform for the teams to present a summary of their work to each other, with an emphasis on all the recent changes and accomplishments made over the last few years.

The symposium was seen as a great team building exercise and greatly improved understanding of everybody's role and value on Aldabra. All staff put considerable effort and preparation into their presentations which were lively, interactive and filled with humor. Overall, the symposium was a great accomplishment on all fronts, showing once again that the successes on Aldabra are built on good communication, motivation and excellent team work!

Cyclone shelter completed at the Aldabra research station

The construction of a cyclone shelter at Aldabra has been planned since April 2016 when cyclone Fantala destroyed infrastructure and vegetation on the island of Farquhar. The damage to Farquhar was a stark reminder of the vulnerability of Seychelles' outer islands, many of which lie at the edge of the Western Indian Ocean cyclone belt, and as ocean temperatures continue to warm, cyclones are likely to occur more often and with greater intensity in future.

The cyclone shelter would be used in the event that Aldabra is hit by a cyclone or tropical storm and there is not enough time to evacuate the atoll, and possibly even as temporary accommodation while rebuilding the research station. A location at the old settlement on Picard Island was selected for the building. The site is in an area that minimises environmental

impacts, has sufficient soft soil to anchor the building and it is far enough from the beach crest in the event of high waves or surge. Given their experience in constructing a cyclone-proof building on Farquhar, the Green Island Construction Company (GICC) was awarded the contract to build the cyclone shelter for Aldabra. We are pleased to report that with the help of fifteen construction workers the project was completed in April 2017.

Water tower

An unexpected, but impressive bit of maintenance which will only be completed next year is the reconstruction of the Aldabra water tower. For 12 years the tower has used the natural pull of gravity to provide water to the station. A simple piece of engineering in design the water tower system compromises of two fibre glass tanks, each able to hold 3,000 litres, sitting atop a mild steel tower. One tank is filled with sea water, used for toilets and the other fresh water for general consumption. While the tower received regular maintenance over the years, Aldabra's high salinity found a way through the coats of paint to oxidise the metal, causing rust and an eventual collapse in August.

With no one hurt or any other infrastructure damaged construction of a new tower started in November. This time galvanized steel frames donated by the Seychelles National Park Authority were used, and concurrent to the

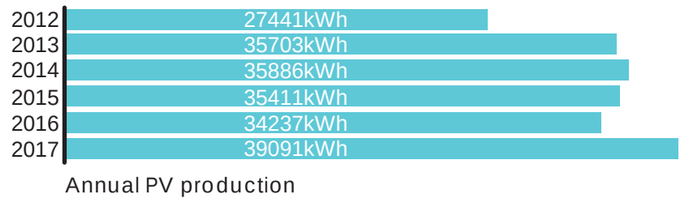
supplying of Aldabra and the visit of the Indian navy, the Aldabra team was able to build the tower's base and erect two pillars. Following this essential assistance the team was able to continued building the remaining two bases, but with human effort limitations, had to stop short of erecting the pillars. Nevertheless, with months until more human effort can be transferred to Aldabra, a determined was able to build a wooden tower to be used in the interim until the new water tower is completed.

Solar photovoltaic system: five years on

As of April 2017, Aldabra's solar photovoltaic system had been in operation for five years. The photovoltaic system was the first hybrid off-grid system of its kind in Seychelles. Although the system had been in operation for several years, President Faure's visit to Aldabra in December was a fitting opportunity to recognise the ground-breaking system and it was officially inaugurated while the President was on Aldabra. See page 47 for more on this VIP visit! The system uses solar panels to harness the power of the sun to generate electricity for the daily needs of the research station. Prior to the installation of the system SIF made several investments in energy efficient appliances, including new A++ energy-certified fridges and deep freezers. This investment halved Aldabra's energy demand and reduced the overall required investment substantially. During its first five years of operation, the photovoltaic system provided 96% (168,685 kWh) of the research station's electricity needs. This is an incredible achievement as the system supports twelve staff houses, offices, a shop, kitchen and mess; including nine air-conditioning units, fifteen fridges, washing machines, the desalination plant and water pumps.

The remaining 4% of energy demand was contributed by a diesel generator. The generator is used only when there is not enough solar energy to meet the electricity demands of the station and when it is necessary to charge the batteries to 100% for maintenance purposes. Due to the reduced reliance on the generator, a total of 185,120 litres of diesel have been saved in the first five years of operation, with a monetary value of SCR 3.1 million! Furthermore, the release of 141,000 kg of carbon dioxide into the atmosphere has been avoided. Investments into energy efficient equipment have reduced the total electricity demand of the station by 61%, which avoided additional 185,200 kg of carbon dioxide in the past five years!

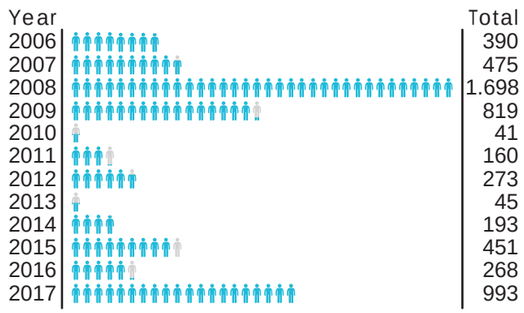
The photovoltaic system continued to perform well in 2017 and produced 39,091 kWh of solar power during the year, the highest annual total since starting operation.



Annual PV production

Aldabra tourism increasing

Although Aldabra is world famous and a bucket list destination for many, the site's remote location makes the atoll extremely difficult and expensive to visit. Most who do visit the UNESCO World Heritage Site do so on small expedition ships during the calm north-west season between November and March. In 2017, a total of 993 tourists visited the atoll and although this doesn't sound like a lot, compared to the last decade, tourism is picking up in the Aldabra group. The increase in tourism is due to the abatement of piracy, but regulations in the Aldabra Management plan as well as the remoteness of the atoll, mean that mass tourism will be prevented on Aldabra – luckily for the atoll's plant and animal inhabitants! The ships are generally small cruise ships of approximately 80–100 people. Many visitors book a ticket on these expensive two-week cruises largely to have the chance to see Aldabra for a few hours and SIF is striving to make the visits as enjoyable as possible for all guests, while ensuring that their environmental impact is minimised. As a result of the newly adopted Aldabra management plan, SIF has set up strict guidelines, boundaries and biosecurity measures to limit the impact of visitors on the atoll, and all activities are centred on and around Picard Island. Popular activities usually enjoyed by tourists are a lagoon cruise from Main Channel to West Channels, observing the frigatebird colony, drift snorkelling in a channel or in front of the settlement, diving, and a land visit. To keep pace with the increasing tourism, throughout 2017, considerable effort was put into developing a series of documents and procedures to aid and guide tourism activities on Aldabra. These include guidelines for tour operators, guides and visitors, and a variety of outreach materials. Although these visits can be hard work, the staff on Aldabra enjoy welcoming fresh faces to the atoll, especially when the visitors are as passionate about discovering Aldabra as the staff themselves are.



Annual visitor numbers to Aldabra

Vallée de Mai research

2017 was a good year for Vallée de Mai research with the Seychelles black parrot breeding season resulting in a large number of hatchlings, and mist-netting and ringing is allowing the research team to better understand black parrot population dynamics and behaviour. Research was published on the seed dispersal and genetic structure of the coco de mer and the plant phenology monitoring protocol received an update. Praslin, and likely the Vallée de Mai, gained a new species of caecilian, and new reptile and amphibian research started filling in the gaps in herpetofauna knowledge in the coco de mer palm forest.

Eighth season of the Seychelles black parrot breeding monitoring programme

The 2016/17 Seychelles black parrot (*Coracopsis barklyi*) breeding season was the eighth consecutive season to be monitored by SIF. Nest monitoring gives us information on the development of the black parrot offspring from egg to fledgling and also allows the comparison of nest success within and between breeding seasons. The monitoring aims to cover as many nests as possible across a broad area, and build on the information gathered over the past breeding seasons to provide insight into longer-term patterns such as fluctuating breeding activity. All potential nest cavities have been mapped and are revisited by the team at the start of each breeding season to assess the continued suitability of the site. Suitable sites usually have deep cavities with solid walls and a flat base, covered by the canopy of surrounding trees, which ensures that the cavity stays relatively dry. Each season newly discovered cavities are added to the list, and those that are no longer suitable due to falling palms or other causes, are removed. This season 62 existing potential nest sites were monitored in the core breeding areas and seven new potential sites were added to the list.

All potential cavities in the core breeding areas are checked once a week. When the team finds an active nest, it is monitored using an infrared camera, ladders and an access door to reach the eggs or chicks inside. The eggs are checked every three days to see if they have hatched. If hatched the chicks are monitored and weighed every three-to-five days to assess their progress. At around 35 days old, just before fledging, the chicks are ringed with a unique colour combination to allow them to be identified in the field. After fledging at about 45 days old, the team continues to monitor the chicks as they are still dependent on their parents for food and very vulnerable to predators, such as cats and rats.

The season was more active and successful than the seventh (2015/16) season, with 16 nests recorded, with a total of 33 eggs laid, 17 of which hatched and 12 chicks fledged. Four of the 16 active nests were in cavities newly discovered this season but none of these nests were successful. All known nests this season were in dead coco de mer trunks.
The seventh (2015/16) season, in comparison, was poor with only three nests located and no monitored chicks surviving to fledging. The reasons behind this fluctuating breeding activity still remain unclear but continued collection of phenology and rainfall data may shed light on the environmental factors, which contribute to the level and success of each seasons' breeding activity. 2015/16 was still feeling the effects of El Nino and breeding activity for many other terrestrial and marine animals in the Seychelles was low for that year, so this may have impacted the parrots as well.

Rats continued to be the main suspected cause for nest failure but this year a noticeable increase in yellow crazy ant activity was observed and suspected to be the cause of nest failure in at least two cases. Although there is not enough evidence to prove this conclusively, the impact of yellow crazy ants on parrot breeding success is something which needs to be carefully monitored.

Black parrot mist-netting

In addition to the breeding season monitoring, black parrots are also monitored throughout the year using mist-netting and ringing. Mist-nets are erected in core black parrot areas, with recordings of breeding calls played through a speaker to attract parrots to the area. When parrots are caught they are processed by taking morphometric measurements, moult data, blood sampling and ringing. Rings are attached to the birds' legs in different colour and pattern combinations so that they can later be identified. New mist-netting equipment was purchased this year, thanks to a Durrell Institute grant awarded to the black parrot team leader, Terance Payet.

Ten mist-netting sessions were carried out this breeding season and 14 parrots were caught, bringing the total number of ringed parrots at the end of this season to 12, with two re-captures. One of these had originally been ringed as a chick more than two years ago during the 2014/15 breeding season. The location where it was re-captured was very close to its nest and it is interesting that it has remained in the area since fledging two seasons ago. Whenever a ringed parrot is seen by the research team the sighting is recorded to shed light on the movement and behaviour of individual birds. 59 re-sightings of ringed parrots were made during the year, in which 25 individuals were identified. Some individuals were seen repeatedly due to their predictable habits or conspicuous behaviour. For example, one bird ringed with silver on both legs was re-sighted 18 times, by far the most re-sightings of any individual, largely due to the fact that she is regularly seen feeding at the entrance of the Vallée de Mai in the mornings and appears to remain in the area throughout the day. She is also more vocal than some other individuals, making her more conspicuous, and was often seen feeding with two of her fledglings that had been ringed earlier in the season!

Coco de mer genetic research

A SIF-co-authored paper was published in 2017 in the peer-reviewed journal Conservation Genetics on seed dispersal patterns and genetic structure of coco de mer (*Lodoicea maldivica*) populations. The paper was based on the results of Emma Morgan's PhD, based at the ETH, Zurich, Switzerland, investigating the genetic and demographic processes underlying reproduction in the coco de mer. Emma completed the PhD at the end of 2016, see the 2015/2016 Annual Report for details.

To answer questions about how far the largest seeds in the plant kingdom disperse; and what effect this limited dispersal potential has on genetic diversity and inbreeding in the remaining coco de mer populations Emma calculated the genetic diversity of palms, Emma found that the average seed dispersal distance was just 8.7 ± 0.7 m. This results in an intense fine-scale spatial genetic structure, with neighbouring pairs of male and female trees being closely related. Inbreeding levels are high, and genetic diversity levels are also relatively high across all populations, although these differed in disturbance and habitat fragmentation. The results indicate that seedlings usually establish in dense clusters around the mother tree, or, if they are growing on a steep slope, in elongated ellipses downhill of the mother tree.

The high levels of inbreeding raise the question of how Lodoicea avoids the problems of inbreeding depression. One possibility is that deleterious recessive alleles have been purged from this long-lived species over generations for thousands of years. Another is that infrequent long-distance pollen or seed dispersal (e.g. downhill) may be sufficient to prevent inbreeding depression at the population level. We still have much to learn about this fascinating species and future research investigating the pollination, germination and establishment consequences of moving seeds to alternative sites will further inform its management and conservation.

The citation details for the paper can be found at the end of the report.

New Seychelles caecilian discovered

Research published by Dr Simon Maddock and co-authors in the journal Zootaxa describes a newly discovered caecilian, taking the number of described caecilian species in Seychelles from six to seven! The newly described species is called *Hypogeophis pti* (petite Praslin caecilian) and is thus far known only from a small area approximately in the centre of the island (including in habitat adjacent to the Vallée de Mai). It has been given the scientific name *Hypogeophis pti*, with the species name (pti) given in reference to the Seychellois Creole spelling of the French petit(e) for small. The new species is not known to exceed 120 mm in total length, and so is one of the world's smallest caecilians, a title for which it competes with its close relative Hypogeophis brevis, known only from the hills of Mahé in the Seychelles. The new species has fewer vertebrae than any other caecilian known (less than 70 vertebrae). The discovery of a new species in an area that is relatively well known, highlights how cryptic and easily overlooked caecilians can be; it is great news that we have more of these unique amphibians than previously thought.

The citation details for the paper can be found at the end of this report.

Herpetofauna monitoring

The Vallée de Mai contains 13 of the 15 endemic Seychelles reptile species and at least five of the 12 endemic amphibians within its 19.5-ha area. The palm forest is a microcosm of Seychelles' high herpetofauna (reptiles and amphibians) diversity and is therefore an ideal location to establish and implement surveys of herpetofauna activity and change over time. Although the herpetofauna in the Vallée de Mai have been studied in various internal and external research projects, until this year there has been no systematic monitoring of these classes incorporated into the Vallée de Mai routine monitoring. This is changing with an exciting new monitoring programme being set up in the Vallée de Mai to start filling in the gaps in herpetofauna knowledge at the site.

The monitoring will start with survey species of diurnal (day-active) reptile, namely the three bronze and two day geckos. Research on these species can be difficult because they can be extremely hard to find. Several different methods were trialled in 2017 to identify the most appropriate to the target species.

Based on the results of the initial monitoring, day transects were most promising and will be developed further and carried out across the Vallée de Mai to assess population density and distribution of gecko species. Given the crucial role herpetofauna play in ecosystems, and the Vallée de Mai's status as a 'herp-hotspot', more information on these species will provide more insight into the Vallée de Mai ecosystem in general. The project is just beginning and methods will be refined over the next few years.

The citation details for the paper can be found at the end of this report.

Aldabra Atoll research

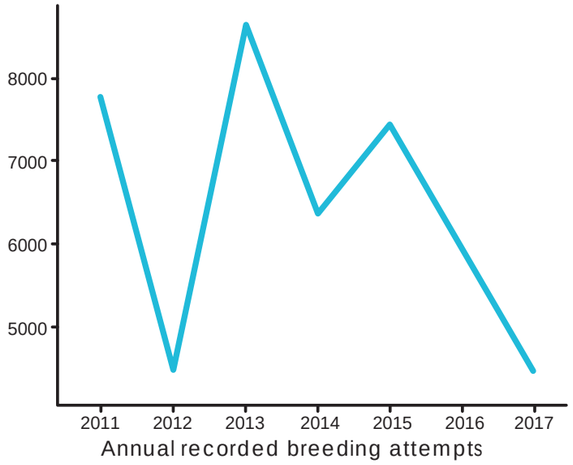
2017 was a year for taking stock on Aldabra with the analysis of long-term datasets for tortoises and turtles, and updates of the monitoring protocols for frigatebirds, tortoises and turtles. Papers were published on the impact of drought on tortoise habitat and a possible new endemic species of Ligia isopod from Aldabra. Anna Koester completed her MSc research on the impacts of the 2016 mass bleaching event on Aldabra's reefs and started a new PhD on coral reef resilience at Aldabra. In-house and external research is contributing to a greater understanding of Aldabra's marine ecosystems, especially coral reefs, and Aldabra experienced the first documented humpback whales stranding at the atoll.

Frigatebird monitoring

Seventh annual frigatebird census

Aldabra holds the largest frigatebird population in the Indian Ocean with approximately 4400 pairs of greater frigatebirds (*Fregata minor*) and 6600 pairs of lesser frigatebirds (*F. ariel*) breeding annually. In early 2011 SIF initiated annual surveys of the four known frigatebird colonies on Aldabra and the 2017 survey was the seventh annual census. The four colonies are surveyed every January or February using methods that collect basic information about the number of nesting pairs and population change. While the breeding at Aldabra is somewhat synchronised in both species, it is more prolonged and variable in lesser frigatebirds than in greater frigatebirds. Conducting the annual survey in January/February was based on earlier research showing that most breeding pairs of both species are likely to be at the chick rearing stage, which limits disturbance to incubating birds.

During the survey all greater and lesser frigatebird adults on nests (incubating or brooding a small chick), and chicks on nest are recorded. To do this, the team approaches slowly by boat along the colony sections, counting and recording GPS points for each colony subsection. Since 2011 these results have been used to provide an estimate of the number of breeding pairs, as well as to map the colony size and extent. The total number of breeding attempts recorded in 2017 was 4453, the lowest for the last seven years although similar to that of 2012.



Large annual fluctuations in the breeding population appear to be normal, particularly in species which do not necessarily nest annually. Factors such as food availability and competition influence individual fitness and there is annual mortality and recruitment into the breeding population, which can substantially increase/decrease the annual breeding population. After an internal review of the monitoring programme, however, it was questioned whether the assumption of peak breeding time from the earlier research was still valid and therefore decided to acquire updated information.

Frigatebird census aims updated

Conducting an annual frigatebird census has inherent challenges in that both greater and lesser frigatebirds are seasonally monogamous and lay one egg each breeding attempt. The duration of parental care is very long – between 12 and 19 months – therefore neither species breeds in an annual cycle, and their breeding cycles are not synchronous. The methods used for the first seven seasons of frigatebird census monitoring were based on a breeding cycle study on Aldabra's frigatebirds done 40 years ago and relied on the major assumption that nothing had changed since then. Additionally, the calculations were complex and open to misunderstanding. It was therefore decided to discontinue calculating annual estimates of breeding population size as and when the aims of the annual census were simplified and updated.

Whereas the census previously aimed to determine the breeding population size and distribution of both frigatebird species on Aldabra, the revised programme aims to obtain baseline data that allows comparisons between years and monitoring of trends. The method does not allow for estimation of actual population size until additional monitoring can be completed to validate assumptions made about breeding periodicity.

In-depth two-year study on frigatebird breeding cycles starts

This additional monitoring commenced in August 2017 when the team began a two-year in-depth study on frigatebird breeding cycles. This programme was designed to document the timing of breeding cycle stages for greater and lesser frigatebirds in each breeding colony. This will give some context to census results by showing the stage of breeding each species is in at the typical time of the census.

To do this the Aldabra research team will monitor a small sub-section each of the four frigatebird colonies every month for two years through the various stages of their breeding cycles. This monitoring frequency is designed to capture the change between stages of the breeding cycle and determine the peak months of breeding activity. Birds are counted according to seven different categories which represent various stages of breeding activity per species.

The new in-depth study will increase our understanding of frigatebird breeding cycles, which in turn will facilitate a more accurate estimate of the breeding population. We will also get a better picture of how the two species are distributed across the atoll. This information will further help us to manage activities around breeding colonies to avoid times when breeding birds are most sensitive to disturbance.

Tortoise monitoring protocol updated

Aldabra hosts the largest wild giant tortoise population in the world, and the species has been monitored by SIF every month since 1998. The primary objective of the monitoring is to provide information required to better understand, manage and conserve Aldabra's giant tortoise population. It aims to ensure the early detection of major changes and allow for management actions to mitigate any problems.

A review of the data collected between 1998 and 2016 was done to assess whether the original methods (developed in 1998) were adequate to meet the original monitoring objectives, whether objectives needed revising. The review identified some shortcomings of the previous methods, such as unnecessarily high frequency of monitoring, underrepresentation of certain habitats on the existing transects, no consideration of detectability of tortoises in different habitats, lack of data on juveniles, and the inability of the monitoring to provide accurate population estimates.

SIF therefore developed a new tortoise monitoring protocol, in collaboration with external researchers and the Zurich Aldabra Research Platform (ZARP) team. ZARP is a multi-disciplinary collaboration between SIF and scientists based at the University of Zurich which was initiated in 2011. The main objectives of the platform are to support research into Aldabra giant tortoise ecology, movement and population genetics, and to explore links between climate, vegetation and tortoises on Aldabra. The new monitoring protocol was finalised in 2017 to accommodate a new multi-level monitoring programme, and is a milestone for Aldabra research. To ensure comparable data to the previous years of monitoring, also encompass higher data quality and value. The protocol details the new procedures for tortoise monitoring using two new methods; distance transects and sweep surveys. Additionally, based on the results, a number of new transects

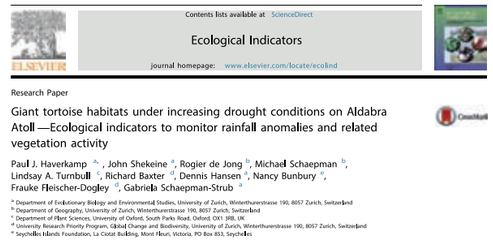
were cut in 2017 to make the sampling scheme more representative of Aldabra's multiple habitats.

Distance transects will allow us to accurately assess the total population of tortoises on the atoll and trends over time. Meanwhile, the sweep surveys will provide vital information on tortoise biology such as size, sex and age, and improve understanding of other factors including their distribution, mortality and recruitment on the atoll. Other components of the sweep surveys involve identifying and monitoring key tortoise nesting areas, as well as a mark and recapture study. Monitoring technology will be improved for better data collection, the distance transects will be conducted using laser pointers and the sweep surveys will be recorded directly on a handheld electronic device, enabling standardized and more efficient data collection. The Aldabra research team started monitoring the new transects in November 2017, and with the new programme fully running we are looking forward to an updated and more accurate estimate of the total population in 2018!

Paper published on giant tortoise habitats under increasing drought conditions on Aldabra Atoll

A ZARP and SIF-co-authored paper on the impact of increasing drought conditions on Aldabra giant tortoise habitats was published in the peer-reviewed journal Ecological Indicators in 2017. The research used long-term monthly rainfall data collected between 1969 and 2013 to identify how many periods of drought occurred each year. Alarmingly, the authors found that in the 1970s there was an average of two 'drought months' per year which has increased to six 'drought months' on average per year today. Satellite imagery between 2000 and 2013 was then analysed to determine how the atoll's vegetation responded to the frequency of droughts. It was found that Aldabra's vegetation is highly responsive to changes in rainfall, with a large increase in vegetation in times with the fewest drought periods and a decrease during times with the most drought periods.

The paper concludes that increased drought frequency is likely to negatively impact the tortoise population on Aldabra, in both the short-term, by limiting the quality and quantity of food and shade available within preferred habitats, and in the long-term, by changing habitat composition across the atoll. As climate change continues to affect regional weather patterns, research that investigates relationships between species and their environment over time, such as this one, provides vital management information for Aldabra.



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Research Paper

Giant tortoise habitats under increasing drought conditions on Aldabra Atoll —Ecological indicators to monitor rainfall anomalies and related vegetation activity

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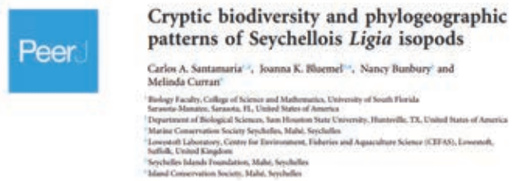
Paper published on Ligia isopods

Another paper published in 2017 described the Ligia isopods of Seychelles, with samples from Aldabra included in the analysis. The lead author, Dr Carlos Santamaria, is affiliated with the University of South Florida Sarasota-Manatee and Sam Houston State University, and the paper was co-authored by SIF, Island Conservation Society (ICS) and Marine Conservation Society Seychelles (MCSS) representatives. Ligia isopods, known as rock lice or sea slaters, usually live in rocky intertidal habitats, although they can survive on both sea and land for a short time. Their biological traits mean that their ability to disperse to new environments is limited, which combined with the patchy nature of their habitat, may lead to long term isolation and cryptic speciation. Species that have evolved through cryptic speciation look virtually identical, but are unable to interbreed and are different enough that they are biologically defined as distinct species.

Cryptic diversity among the Ligia isopods in the Pacific and Atlantic has been found in previous research, and there have been numerous reports of cryptic diversity in terrestrial organisms of the Seychelles. Santamaria and co-authors therefore set out to investigate whether Seychelles' coastal invertebrates also harbour any cryptic diversity. To do this they studied the genetic diversity of Ligia isopods using mitochondrial and nuclear markers, characterising individuals found on the Inner and Outer islands. The research suggests that there may be two to three new species of



PeerJ

Cryptic biodiversity and phylogeographic patterns of Seychellois *Ligia* isopods

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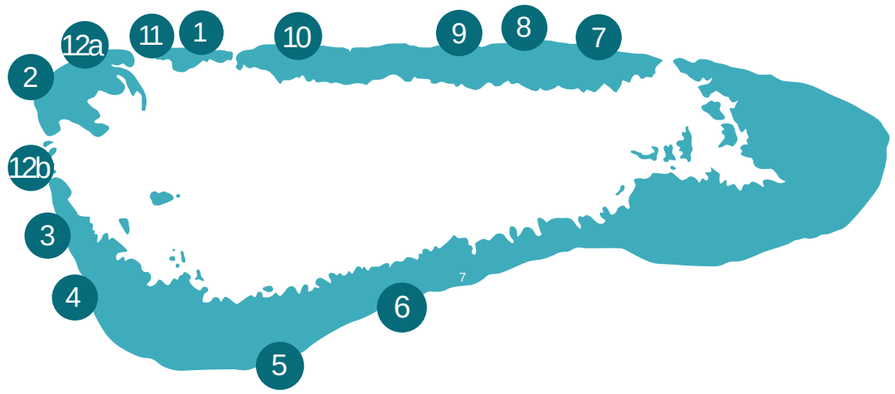
Completion of the fourth season of marine monitoring

The fourth season (2016/17) of Aldabra's marine monitoring programme was completed in 2017. The marine monitoring programme is divided into the Aldabra Reef Monitoring Programme (which monitors coral reef fish and benthos), the Baited Remote Underwater Videos (BRUVS) monitoring programme (larger predatory fish), and data logger monitoring (sea surface temperatures), plus coral bleaching and recruitment surveys when this is required.

Since 2013 the Aldabra Reef Monitoring Programme has monitored coral reef benthic communities and fish assemblages on an annual basis at 12 permanent sites around the atoll. The 12 sites are monitored with benthic photoquadrats (i.e. photos of squares on the seabed) and fish surveys. Additionally remote loggers gather information on temperature and tides. The programme was designed to monitor the state of Aldabra's diverse marine life, but as demonstrated by the 2016 global bleaching event, the monitoring data also serves as a valuable reference point for environmental changes in the region. In preparation for the fourth season of reef monitoring, methodologies were documented extensively to ensure continuation and standardisation of the Aldabra reef monitoring programme over the long-term. The team consisted of four divers, the skipper and the boat hand. In November and December 2016 benthic photoquadrat surveys, fish belts as well as coral recruitment surveys were carried out at all 12 sites. Coral recruitment surveys are done in addition to the core tasks of the reef monitoring, because these provide one of the best indicators of coral reef resilience. This is particularly important this season as the monitoring was conducted almost a year after the mass bleaching event.

The results of the reef monitoring showed that following the coral-bleaching event in 2015/2016, hard coral cover was reduced overall by ca. 50% and more severe loss was observed for soft corals. The highest overall coral cover remaining was ca. 23–28% at two sites in 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. Overall, herbivores were the most abundant fish across all sites. Despite such high coral mortality the reefs are already showing signs of recovery and thankfully in 2017 the sea temperatures did not reach dangerous levels, allowing corals a reprieve from temperature stress. One thing that is widely apparent at Aldabra compared to other regions is the sheer abundance and size of herbivorous fish such as parrotfish and surgeonfish, a good indicator of the resilience of the Aldabra coral reef ecosystem; these species graze extensively on algae, freeing up space for corals to re-colonise.



Aldabra B/RUV Monitoring stations

The BRUVs monitoring survey assesses the effectiveness of Aldabra's management zones on fish abundance and diversity. This is done with BRU cameras. BRUVs are an exciting way to survey groupers, large assemblages of snappers and diver-shy sharks and rays at depths of up to 50m. A bait canister draws these species towards a camera and thirty videos of one hour each are collected in six different zones around the west and south coast of Aldabra. The zones have been selected to represent subsistence fishing and conservation areas to determine the impact of the subsistence fishery on Aldabra's fish community. In this way, SIF can respond with adaptive management strategies to reduce the impact, making it a valuable tool for the conservation of Aldabra's fish community.

The 2017, BRUV monitoring marks the first baseline survey within the newly set up and enforced zoning scheme for Aldabra. The zoning strategy delimits three types of management zones around the atoll, namely the 'conservation zone', the 'food security zone' (the only zone in which subsistence fishing is permitted) and the 'tourism zone'. The BRUV monitoring this year was focussed on fish abundance and diversity at 30 sites within the conservation and food security zones. This will help to determine the impact level and sustainability of subsistence fishing on the fish community. If required SIF responds with adaptive management strategies, if required, to reduce the impact – as stipulated in the new Aldabra Atoll Management Plan. The analysis of the videos involves visually documenting all target species and the time at which they are seen.

The results so far revealed higher fish numbers and species richness in the conservation zones than in the food security zones, but more rigorous analysis will be required once the zoning strategy has been in place for several years. Shallow sites record the highest number of fish, followed by medium depth sites and deep sites. This is probably linked to the occurrence of coral reef habitats within these depth ranges around the atoll. A total of 66 fish species were surveyed across all sites and depths. The dominant fish families in both management zones were alike and were predominantly butterfly fish, groupers and snappers.

The BRUV protocol includes a selection of ten 'target species' for reporting on relative abundance and incidence. These are indicator species that are sensitive to fishing, diving, or changes in environmental conditions. All of the species were recorded in the BRUVs, including six species of shark. Grey reef sharks were the most common of the sharks and one video recorded 13 grey reef sharks in a single frame! In shallow water blacktip reef sharks were the most abundant shark species, with grey reef sharks most abundant at medium depths and silvertip sharks at deep sites.

PhD started on coral reef resilience at Aldabra

Anna Koester, former Aldabra marine volunteer, started her PhD in June 2017 at the University of Bremen, Germany. She is investigating patterns and drivers of coral reef resilience at Aldabra. Due to the absence of local human impacts, such as overfishing, development and pollution, remote coral reefs are considered to be healthier and more resilient to threats, including climate change. It is generally assumed that this is the case at Aldabra, but the resilience of Aldabra's reefs has not yet been studied, and the drivers of resilience are poorly understood. For her PhD research, Anna will aim to confirm whether Aldabra's reefs are actually resilient and if early recovery potential of the reefs can be detected.

Anna will study indicators obtained from the long-term monitoring of the reef, as well as additional indicators of ecosystem processes. Benthic data from Aldabra's long term marine monitoring will be analysed together with data on the environmental conditions of the reef, to identify the spatial and temporal differences in bleaching response across coral genera. Aldabra marine monitoring data collected before and after bleaching will be used to quantify the 2016 bleaching mortality, to identify potential shifts in community composition in terms of benthic organism cover, diversity of coral genera and coral morphologies, and to identify the potential for reef recovery. All of this information will be compared to the bleaching susceptibility and trajectory of the 1998 bleaching event to identify potential trends. The drivers of local bleaching susceptibility/ recovery will be determined using in-water assessments of several ecosystem processes. Finally, to evaluate the resilience of Aldabra's reefs in terms of the absence of local human stressors, the bleaching impact and trajectories of the reefs of the inner islands will serve as a comparison.

Anna embarked on her first phase of fieldwork in December during the annual Aldabra reef monitoring surveys. During her monitoring dives, she visited all the 5m sites and collected data on structural complexity, measured turf algae growth and height, collected sediment samples and placed ceramic tiles for surveying coral recruitment. A second round of data collection will be conducted in February 2018 to complete her first season of fieldwork, and then she will return to Aldabra in December 2018 to carry out the second and final season. Understanding coral reef resilience at Aldabra, and in the region more broadly, will be of vital importance for management decisions and we are looking forward to Anna's results!

Aldabra becomes part of a region wide tropical cyclone forecasting system

As part of the 'ReNovRisk-Cyclones' project which aims to study the meteorological and oceanographic impacts of cyclones on the territories of the South West Indian Ocean, Aldabra received its first GPS ground station. Funded by the EU, and installed by a team of researchers led by Dr Olivier Bousquet from University of La Réunion, with the assistance of Theron Moncherry from the Seychelles Meteorological Authority and of course the Aldabra team, this ground station will be useful in measuring and predicting tropical cyclones. By sending a repeated signal and measuring the time taken for this signal to be received by orbiting satellites the system is able to measure the atmospheric water vapour concentration. The availability of this data improves regional weather forecasts, allowing the monitoring of the distribution of water vapor in different areas over time, helping to measure climate, and evaluate climate simulations. Aldabra is the first island in the South West Indian Ocean to have this equipment installed and it is planned that other areas in Madagascar, La Reunion, Mozambique and Mayotte will soon receiver similar stations.

Furthermore, the ReNovRisk-Cyclones project team will also potentially be developing an exploratory approach to use seabirds to measure sea surface temperature and currents near tropical cyclones or areas of heavy convection. As Aldabra has a breeding population of tropicbirds, the atoll might be included as part of this component in which case the project team may potentially visit again during the next few years. Green turtles could also be a potential source of information. Although the project will run for three years, the GPS is to remain in place indefinitely for data collection.

PhD research on population genetic structure of mangroves

Dennis de Ryck, a PhD student at the University of Brussels, finished his thesis on the population genetic structure of mangroves in the Western Indian Ocean. His research investigated the processes of dispersal, the resulting patterns and the consequences or effects on the genetic population structure in mangroves. This PhD incorporates an analysis of population genetics of the magliye blanc (white mangrove) *Avicennia marina* in the Western Indian Ocean and includes data from Aldabra. Mangrove sampling by the Aldabra research team for this project occurred in 2013 in the areas of Ile Michel and La Gigi.

The data reveals a higher level of genetic diversity in the Aldabra population compared to other groups in the Western Indian Ocean, indicative of recent, recurrent long-distance dispersal events. The data shows an eastern origin (Seychelles or East Madagascar) of mangrove propagules on Aldabra. Therefore it is believed that successful dispersal of mangroves towards Aldabra occurs or occurred extremely rarely, but it did so either repeatedly or several diverse mangrove propagules arrived at the same time.

MSc completed on 2016 mass bleaching event

Julia Cerutti, a University of Zurich student, completed her MSc thesis in 2017 on the impacts of the 2016 mass coral bleaching event on the reef benthic community around Aldabra, with implications in particular for the long-term structural stability of coral reef ecosystems. Given the expected increase in frequency and severity of bleaching events, the community structure of coral reefs is likely to undergo changes in the coming decades, especially given that some genera suffer higher mortality than others. Using data collected during the second and fourth seasons of the Aldabra reef monitoring programme, before and after the bleaching, Julia evaluated the benthic cover compositional shift following the 2016 bleaching event.

She found that at the peak of the bleaching, 60–99% of coral cover was affected by bleaching across sites, with bleaching severity varying between species. Benthic data acquired pre- and post-bleaching and derived from photoquadrats showed that Aldabra lost more than 50% of its reef-building corals following the event, along with more than 90% of its soft corals. The significant decrease of both hard and soft corals, plus the increases of coral rubble, coralline algae and turf algae clearly indicate a benthic community composition shift following the major disturbance. In addition, despite the overall decline of hard corals, the response varied among genus. Some of the reef-building stony taxa were the worst affected.

Even if no additional bleaching occurs in the coming years, further changes in the reef assemblage are expected as part of the recovery. This underlies the fact that species that have increased in the short-term are not necessarily the ones that will in the long-term. Conservation priority should be given to reefs with a higher likelihood of persisting and greater resilience.

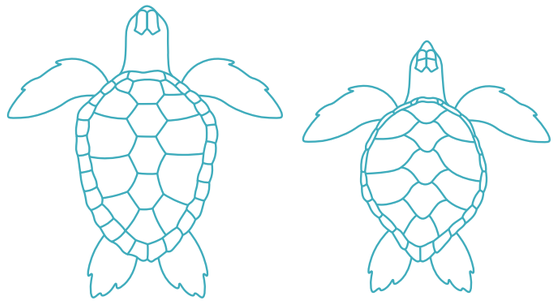
In-water turtle monitoring

The Aldabra lagoon has long been recognised as an important developmental and foraging habitat for large numbers of juvenile and immature green and hawksbill turtles and the team on Aldabra has regularly conducted in-water monitoring of these turtles since 1996. Captured turtles are tagged on both flippers, measured, weighed and released. A recent in-house analysis of data from 20 years of in-water monitoring of juvenile turtles in the Aldabra lagoon revealed some interesting trends and information.

After 20 years an impressive total of 937 green and 392 hawksbill juvenile turtles have been captured in the waters of Aldabra's lagoon.

937
Green turtle

392
Hawksbill turtle



Amount of green and hawksbill juvenile turtles tagged over 20 years.

Interestingly, green and hawksbill turtles use the lagoon areas differently, with the majority of hawksbills found in the eastern lagoon and most greens in the western lagoon. This may be a response to the large areas of coral and sponges in eastern Passe Houareau which hawksbills preferentially consume; while greens, which prefer to eat macroalgae, are more restricted to suitable habitat in the western lagoon. Turtles also showed extremely high site fidelity with most recaptured turtles being caught in the same or a neighbouring location to where they were first captured. Size data suggests that juvenile turtles enter the lagoon from their pelagic hatchling stage when they are 25-30cm in length and a large number appear to leave when they reach around 60cm in length.

The analysis of historical turtle in-water data also provided the opportunity to revise the turtle monitoring protocol to ensure that monitoring is efficient and the results are useful. The revised protocol has ensured that the results are relevant for the questions addressed by the monitoring. It was also an opportunity to modernise some of the methods; back in 1996 the results were stored on paper, but all of the historical data has now been stored in a database designed to standardise data, which makes data entry faster and easier for staff, and minimises errors.

Green and hawksbill turtles are listed by the IUCN as globally endangered and critically endangered, respectively. 20 years of monitoring has shown that Aldabra continues to be one of the most important sites for the conservation of these species in the Indian Ocean.

South-east monsoon marine megafauna

Marine mammals are often seen on boat trips to the lagoon and along the outside shores of the atoll, especially resident spinner dolphins, sometimes in groups of up to several hundred, but the south-east monsoon season brings more wide ranging marine megafauna to Aldabra's shores. This can include manta rays, humpback whales and occasionally such rarities as orcas and other whale species. The most conspicuous visitors are the humpback whales and 2017 was an incredible year for humpbacks, with over 100 sightings of groups of between one and six whales, including females with calves. In fact, the team were lucky enough to snorkel with two adults and a calf!

At the end of September 2017 Aldabra experienced a whale beaching at Passe Hoareau on the north coast. Returning from a field camp, rangers came across two stranded adult humpbacks and one still-swimming juvenile. They appeared to have come into the lagoon on the high spring tide and become stuck on the reef as the tide receded, although it remains a mystery as to why they entered the lagoon in the first place. The causes of whale strandings often remain unknown, and whereas human impacts (such as pollution, injuries from boat collisions or noise from ships) have been implicated in some, Aldabra's isolation makes this unlikely.

Locations of the stranded whales

Despite attempts to save them, the location and sheer size of the whales meant the team were not able to move or refloat the adult whales. The adults died where they stranded, and the juvenile was later found dead at Ile Michel on a return trip to the area two weeks later. The stranding of these three humpbacks, while a terrible end for the whales themselves, provided a feeding bonanza for reef organisms for months afterwards. The day after the deaths, nurse, lemon and tiger sharks converged on the whales. Staff rarely see more than one tiger shark at any one time, so this was a special event – at least one of them was in excess of 4 metres long. Staff have recovered some of the bones which will be used for educational purposes in Aldabra House.

Microbiology research expedition

A team of microbiology researchers under Dr. Gernot Arp, a geobiology expert from the University of Göttingen, visited Aldabra from November to December as part their project entitled "Microbial alteration of geochemical and isotope proxies in fine-grained carbonate sediments". Through the project the hoped to find cyanobacteria and stromatolite, which had been previously recorded on Aldabra (Braithwater et al. 1989), within Aldabra's pools and the lagoon sediments (carbonate mud). However, the team's expectations and theories did not match their discoveries. Although recent remote sensing of Aldabra indicated the possibility of carbonate mud, maps don't show sediment thickness. Upon ground proofing the carbonate mud was not found where it was hypothesised to be. Another major discrepancy between expectations and findings was that mangrove trees do not grow in mud, but rather on and around limestone karst, where the mud's thickness is extremely thin.

Despite these disappointing findings, a result of Aldabra's low sedimentation rate and strong tidal currents that prevent carbonate build-up, the team was able find a few carbonate mud samples. But more encouragingly discovered stromatolites at West Pool. An incredible success which they hope to translate into a strong important scientific publication, once the makeup and stromatolites of West pool is analysed. It must be noted that the team's tight and an ambitious schedule of moving around atoll was a potentially limiting factor to their success, but any benchmark of success was made possible by the team, especially our experienced Ranger Ronny Marie, who was their personal expedition guide, showing them sites that are not usually visited. The team's luck also turned out in different ways in spotting a dugong on one of their return trips from the lagoon to the station. At the end of their stay on Aldabra Professor Gernot gave a very informative presentation on their work and results. With this foray completed the project's research agreement is set to be expanded to focus on the microbiota of Aldabra's wildlife with specific interest on giant tortoises. Moreover, the team is interested in generating a first insight into the atoll's different microbial communities, as well as the water chemistry below the frigatebird colonies.

Invasive species activities

SIF's work to eradicate and control invasive alien species and to prevent new species from establishing was substantial in 2017, with activities on Praslin, Mahé, Aldabra and Assomption. Exciting and ambitious projects started in the Vallée de Mai and Aldabra to manage invasive alien species already occurring within the sites and to prevent new species from establishing. After a momentous effort the Madagascar fody was eradicated from both Aldabra and Assomption, making Aldabra once again the largest tropical island in the world that is free of introduced birds.

The sisal eradication on Aldabra and the Ring-necked parakeet eradication on Mahé both entered their final phase, and work started on several previously uncontrolled species in the Vallée de Mai. SIF's Director of Research and Conservation, Dr Nancy Bunbury, attended the Island Invasives Conference in Dundee, Scotland and presented the lessons learned so far from SIF's work on invasive bird eradications. The presentation received positive feedback, stimulating discussion on similar eradication projects worldwide and confirming that SIF is a leader in invasive alien species management. 2017 wasn't all good news however, and the annual yellow crazy ant survey revealed an alarming increase in the distribution of this incredibly challenging invasive alien species.

Invasive alien species on Aldabra

Aldabra biosecurity project starts

In May a new European Union (EU) funded project, managed by the Indian Ocean Commission, was launched to implement the Aldabra biosecurity plan which was developed in 2014. The project, '**Institutionalisation and implementation of biosecurity measures to ensure sustainable conservation management of biodiversity on Aldabra Atoll**', aims to prevent future invasive species introductions to Aldabra. Putting these measures in place is also an essential prerequisite for future eradications of invasive alien species still occurring on Aldabra.

The term 'biosecurity' refers to all policies and measures implemented to minimise the entry and spread of invasive alien species. Aldabra's relatively undisturbed ecosystem and comparative lack of invasive species, makes the arrival and establishment of new invasive species the most serious threat to the biodiversity and ecological integrity of the atoll. SIF has been actively eradicating key invasive alien species, such as goats, red whisked bulbuls and sisal, on the atoll. However, to maintain the successful outcomes of these projects, ensure the protection of Aldabra and to prepare Aldabra for a future rat and cat eradication programme, it is essential to have strong biosecurity measures in place.

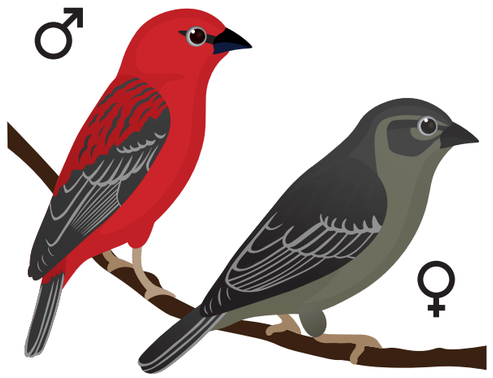
A comprehensive biosecurity plan for Aldabra was developed in 2014, and a biosecurity protocol was written in 2015. The plan had been only partially implemented because SIF lacked the required infrastructure, materials, facilities, and related institutionalised procedures to conduct the essential biosecurity measures. The new project will change this by strengthening biosecurity measures and infrastructure, and creating an institutional framework that incorporates management and monitoring procedures.

Biosecurity measures at the Mahé head office and on Aldabra became more deeply integrated into the organisation, with the creation of biosecurity roles at both sites. All staff were trained in conducting biosecurity checks and a much greater focus on biosecurity reporting began. Biosecurity checks are conducted on Mahé and Aldabra for every transport of people and supplies to the atoll. Presentations were given to cruise ship guests whenever possible to explain biosecurity, and the newly created Aldabra tourism package includes a section on the threats of invasive alien species and a list of biosecurity regulations for tourists. Sealed drums were sourced to package supplies to reduce the risk of invasive alien species infestation during the transport phase.

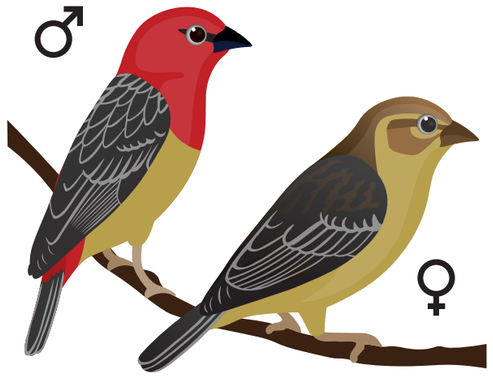
Although significant progress was made in 2017, Aldabra's biosecurity is still not as thorough as it needs to be. Under this project there will be a much greater focus on biosecurity in 2018. The construction of a dedicated biosecurity building on Aldabra will begin in early 2018, an international biosecurity specialist will conduct training on Aldabra and Mahé and will also review developped plans and protocols to continue improving biosecurity measures for the atoll. Biosecurity is now an integral part of procedures at SIF and will continue to be a high management priority for keeping Aldabra's ecosystems intact and undisturbed.

Aldabra eradication of Madagascar fodies completed

After a final monitoring trip in March 2017 the Aldabra team confirmed that there are no introduced Madagascar fodies in the formerly invaded Takamaka region of the atoll. This follows the 2013 eradication of the Red-whiskered bulbul from Aldabra, so the atoll can once again be considered entirely free of invasive alien birds! Aldabra held this status until 2012, when both Madagascar fodies and Red-whiskered bulbuls were discovered in this little-visited region of the atoll during monitoring to confirm the goat eradication in 2012. The conclusion of one invasive species eradication therefore led immediately into an emergency race against time to remove the introduced bird species before they became too numerous and widespread for eradication to be feasible.



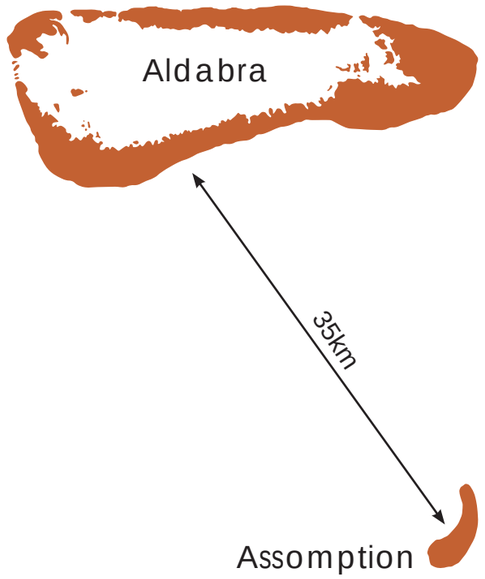
Madagascar Fody breeding plumage



Aldabra Fody breeding plumage

The most severe threat of the new introductions was to Aldabra's endemic landbirds. Aldabra has its own endemic species of fody, and a subspecies of Madagascar bulbul; both faced risks from the new arrivals, including hybridisation, novel pathogen transmission and competition for food. Fortunately, emergency funding was sought and secured from UNESCO very quickly. An old field camp was completely refurbished at Takamaka in 2012, and over the next three years, intensive eradication efforts were carried out with a team of four to six people. The Red-whiskered bulbul 'population' was found to be only a single individual, which was culled in 2013. Madagascar fodies, however, were well-established and took three seasons of dedicated work to remove. The eradication work was particularly tricky because Madagascar and Aldabra fodies are very difficult to distinguish outside the breeding season; even during the breeding season it can be a challenge to correctly identify non-breeding individuals from afar. Most of the eradication was therefore done seasonally, from November to April each year, using mist-nets, so the team could confidently distinguish the invasive fodies from the endemic Aldabra species.

The last known Madagascar fody individual was culled in January 2015. Since then, the Aldabra team has carried out two monitoring trips per breeding season to survey the whole area and carry out extensive observations. Not one of the four trips has detected a fody other than the endemic Aldabra species and, with a final visit to the area in March 2017, more than two years after the last Madagascar fody was shot, we are now confident that the eradication was a success. More than 200 Madagascar fodies were culled in this eradication. We encountered quite different challenges compared to the other bird eradication projects SIF has implemented, which could easily have compromised chances of success, but we were lucky to be in a position to act quickly and complete the eradication in a relatively short time with a dedicated team (several of whom had first been trained on the Assomption bird eradication).



5km
Distance between Aldabra and Assomption

We are extremely grateful to our main funder, UNESCO, for responding so quickly and favourably to our emergency request and providing the initial essential support to get this eradication started. Most importantly, our thanks goes to the many dedicated and competent members of the team, staff and volunteers, local and international, for braving the baking heat and treacherous terrain in probably the most logistically frustrating part of Aldabra, from refurbishing the field station, conducting intensive eradication efforts, through to the final monitoring efforts.

Aldabra sisal eradication progress

Sisal (*Agave sisalana*) was likely introduced to Aldabra by early settlers for its tough hemp-like fibres, and it was known to occur at four sites on Aldabra; Picard (at and around the old settlement), Anse Polymnie, Anse Malabar and Ile Michel. The species is an invasive alien that spreads quickly and can create impenetrable 'stands' where other plants cannot grow. The plant also out-competes other native flora, reducing available habitat and biodiversity as well as food sources for other wildlife.

Efforts to remove sisal from Aldabra started in the 1970s. However these were only partially successful and in 2012 the eradication effort resumed under SIF's EU-funded invasive alien species project. The difficulties of physical removal prompted investigation into the potential for chemical control of the plants and experimental trials were done over seven months in 2013/2014 to determine the most effective and least disturbing control method.

Following the trial, several visits were made by the Aldabra team in 2015 to the four locations where invasive sisal plants had been treated with the most effective method. At all sites except Ile Michel, the team saw no re-growth of the plants on any of the visits. Ile Michel, which originally had by far the largest stand of sisal, was found to have a small amount of regrowth of sisal plants. These plants were re-treated with herbicide and follow-up visits were made in 2016. In December 2016, just four new shoots were found, which were treated in January 2017. In 2017, follow-up visits were conducted in May, October, November and December with no shoots seen on all visits. The final checks on Ile Michel will be done in 2018 and if no shoots are seen, the eradication will be declared successful and Aldabra will be officially, after forty years, free of sisal.

Assomption

Assomption Madagascar fody eradication

Following the successful eradication of the red-whiskered bulbul from Assomption in 2014 (see the 2014 Annual Report for details) further good news came from the island this year. After three years of intensive eradication efforts and two more years of not seeing a Madagascar fody on the island of Assomption, the eradication of this introduced species was confirmed to have been successful! The two invasive alien bird species were introduced to Assomption in the 1970s from Mauritius and the presence of these introduced birds on an island only 28km from Aldabra was highlighted as early as the 1980s as a significant potential threat to Aldabra's native birds. Aldabra, at the time, was the largest tropical island in the world on which only native bird species occurred. Funding to start an eradication programme for both species on Assomption was finally secured in 2010 from the EU, co-financed by SIF. Preparation work and trials of methods started on the island in late 2011 and the eradication was launched in early 2012.

Three years of permanent presence on the island by an SIF team of between two and ten staff followed, with more than 30 different staff, volunteers and students being involved in the eradication activities through the whole project. The dominant method of bird capture shifted from mist-netting at the beginning of the project to mainly shooting after the mid-point, as the density of the birds dropped and the remaining birds became ever more wary. The last year of the project was the most difficult, with dedicated staff relentlessly pursuing the last handful of highly sensitised birds. At this late stage the team could spend up to several weeks targeting each individual, so every single bird successfully eliminated was a cause for quiet celebration and relief.

Over 3.200 Madagascar fodies were eliminated, with the final bird shot in January 2015, but it could not be confirmed at the time that this was the last bird. Three further months of intensive continuous observations were required to convince the team that there were unlikely to be more fodies on the island. Four major follow-up monitoring visits to Assomption have been carried out since then, with no sign of Madagascar fodies. Multiple shorter visits by Aldabra staff transiting Assomption have also occurred during this time with all eyes trained for any signs of the introduced birds. After two years with no traces of Madagascar fodies on Assomption, we are at last confident that the eradication, along with that of the red-whiskered bulbuls, can be considered a success.

After this lengthy eradication mission and innumerable unexpected complications along the way, it is with enormous relief, and sincere gratitude to our partners, the Islands Development Company and ICS, and our funders, the EU, that we are able to announce the successful eradication of Madagascar fodies from the island of Assomption. We would also like to thank everybody who has been involved in this huge eradication effort: consultants, team leaders, long-term staff, hunters, students, volunteers, Aldabra staff and all Head Office staff, every one of you was a needed part of the team and helped to secure this remarkable achievement.

Invasive alien species in Vallée de Mai

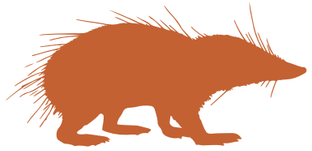
Inva'Ziles project

In mid-2017, SIF was awarded funding for a 14-month project to manage invasive alien species in the Vallée de Mai. The Inva'Ziles project, titled "Preparation and testing of a comprehensive model for preventing and managing the spread of invasive species on island ecosystems", is financed by the European Union and implemented by IUCN, it includes funding for demonstration projects in the three main target countries of the project, Comoros, Mauritius and Seychelles. The aim is to assist the three countries to increase the effectiveness and amplify the range of invasive alien species management activities.

SIF applied for the project 'Pioneering a holistic approach in managing invasive species in protected areas and testing it in the Vallée de Mai UNESCO World Heritage Site'. The impetus for the project followed heightened and urgent concerns about invasive alien species in the Vallée de Mai, particularly in light of the recent yellow crazy ant expansion throughout the site (see next article, and SIF's 2015/2016 Annual Report), and impacts of rats on black parrot nest success. Four new staff members were recruited to the Vallée de Mai team as part of the Inva'Ziles project. Sarah Atkinson has joined us as the Project Coordinator, Véronique Couttee is the new Inva'Ziles Project Officer, Júlia Kovács has joined us as the Black Parrot Data Officer and Sascha Dueker will be working as Black Parrot Volunteer.

The project aims to develop new methods for managing several invasive animal and plant species in the Vallée de Mai, and most of these methods will be new to Seychelles. The overarching goal is to implement these methods holistically, by managing invasive alien species comprehensively at an ecosystem level, targeting not only one narrow group of species but species from a broad range of taxa, including plants, mammals and invertebrates. This approach, managing invasive alien species alongside each other, is hoped to facilitate multiplication effects and benefits for the entire ecosystem.

The project aims are to:



Control introduced tenrecs in the palm forest and manage their impacts on endemic fauna. Tenrecs prey on native invertebrates, amphibians and reptiles in the Vallée de Mai, and through stomach analysis it is hoped that the Inva'Ziles project will be able to better assess impacts of this invasive alien species on endemic fauna in palm forest.

Carry out a controlled pilot management study to reduce rat density around Seychelles black parrot nests and determine impacts on breeding success. Black parrot breeding success has been monitored by SIF for eight consecutive seasons and rats have been implicated in the failure of many nests during this time.

Test methods to control highly invasive yellow crazy ants in the Vallée de Mai and prevent them accessing canopy trees and black parrot nests in the infested area. Yellow crazy ants have been shown to have a detrimental impact on native fauna in the Vallée de Mai, including black parrot chicks and a range of invertebrates, reptiles and amphibians. The project will include two strategies, decreasing the population of the ants and also restricting access to the tree canopy.

Identify the best methods for controlling the invasive plants Epipremnum pinnatum, guava Psidium cattleianum, and cocoplum Chrysobalanus icaco in the palm forest. SIF has worked intensively with invasive plants in the Vallée de Mai since 2012 and managed more than ten plant species under the EU-funded project (2011–2015) to determine the most effective control method for each. Results have been upscaled to large-scale control of these species with good success. The Inva'Ziles project aims to expand the scope of the existing programme by extending and tackling new species and determining the best control methods for these lesser known but equally problematic invasives. Determine the most effective combination of different methods to increase the overall result of invasive alien species control in palm forests.

By managing invasive alien species comprehensively and holistically, targeting not only one narrow group of species but rather a broad range of taxa, including plants, mammals and invertebrates, SIF expects that the project will bring ecosystem-wide benefits of invasive species control in the Vallée de Mai. By the end 2017, the team was very busy trialling new and innovative methods, and we expect that invasive alien species control in the Vallée de Mai will move into a new era in 2018.

Annual yellow crazy ant survey

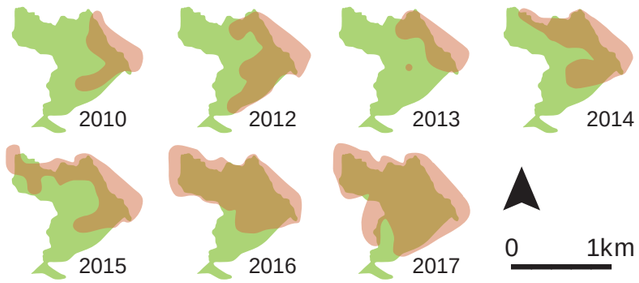
In 2017 the Vallée de Mai research and Inva'Ziles project teams conducted the annual survey of yellow crazy ants in the Vallée de Mai using the pitfall trap method that was trialled in 2014. This was the eighth yellow crazy ant survey to be conducted in the Vallée de Mai and the fourth time using the revised methods of pitfall traps.

The aims of the annual survey are to monitor the distribution and abundance of yellow crazy ants within the Vallée de Mai over time and understand the relationship with ecological factors. At each survey point, a pitfall trap is set up, consisting of a plastic bottle partly buried in the ground with slots in the side, filled with a sugar, soap and ethanol solution. After 24 hours the team collects the traps and recorded the humidity and temperature of the site. The team also records the ant communities on trees with and without scale insects. The pitfall traps are then examined and the number and identity of the different species caught recorded. In addition to yellow crazy ants and other ant species, other insects and organisms in the traps are identified where possible and recorded, including mosquitoes and scorpions.

During the 2016 survey yellow crazy ants were present at 37 of the 50 sites, representing a large increase in coverage to 74% of the Vallée de Mai and triggering the Inva'Ziles. In 2017, however yellow crazy ants were present at 46 points, and therefore absent from only four points. This represents a substantial increase in distribution to 92% coverage of the Vallée de Mai in the last 12 months. While

they were previously restricted to the northern and eastern areas of the forest, they are now also found throughout the western parts of the Vallée de Mai and are likely to spread to cover the entire site. The average abundance per point also increased from 53 yellow crazy ants in 2016 to 88 ants in 2017. Another ominous sign of increasing numbers was that a maximum of 850 yellow crazy ants was recorded at a single point; the highest ever previous count was 651. The considerable increase in the distribution and abundance of yellow crazy ants requires urgent action as they pose a serious threat to virtually all fauna of the Vallée de Mai.

Although this increase is of great concern, it is fortunate that the Inva'Ziles team is on the ground and already hard at work trialling the most effective and environmentally friendly methods to control yellow crazy ants and experimenting with canopy access restriction for trees that contain black parrot nests, which we hope to be in a position to upscale across the site in 2018.



YCA distribution(■) in Vallée de Mai(■) from 2010 to 2017

Mahé

Ring-necked parakeet eradication on Mahé

By the end of 2016, the Ring-necked parakeet (*Psittacula krameri*, kato ver in Creole) eradication programme had made excellent progress. The project was considered to be in its final stages, with the last known bird culled in May 2016 and no known parakeets remaining on Mahé. However, reports of a Ring-necked parakeet surfaced in February 2017. Emergency funding was secured from the Environment Trust Fund and an observation team was mobilised by June 2017. The team consisted of Annabelle Constance, SIF Science and Projects Coordinator and part of the original eradication team, Jeremy Waters, a volunteer with previous experience eradicating mynah birds from North Island. The team spent more than two weeks searching for signs of parakeets that were reported on the west coast of Mahé. They surveyed key points in the area, including all areas reported by the public, to try to locate the reported birds. Additionally, they carried out observations of known parakeet feeding sites and flight lines in other areas on Mahé for any remaining birds. After their observations, the team neither heard nor saw any parakeet activities on Mahé.

Distance between Mahé and Praslin

Meanwhile, a reported ring-necked parakeet sighting surfaced from Praslin and a team was quickly deployed to the island to follow up the report. In spite of extensive observations and detective work, no parakeet was seen on Praslin. The Praslin ring-necked parakeet team has also intensified their public awareness campaign to reach a greater number of Praslinois residents, as this was the third report from the island in just under a year and none of the sightings had been verified. The campaign included many more posters being put up in several parts of Praslin. After following all leads it was concluded that the reports had been false, possibly a case of mistaken identity, and the focus could return to finding the bird reported on Mahé.

In July the team was joined by Julio Agricole and Jessica Moumou, Invasive Alien Species Technicians, who were also part of the original eradication team. Shortly after, there was a breakthrough, and a single bird was seen by SIF on several occasions in the Morne Blanc area. The priority became narrowing down the bird's flight lines, feeding and roosting sites and confirming whether it was a lone bird or if there were more. Instrumental in the process were Mr and Mrs Damou, of Morne Blanc, who notified the team each time they saw the bird in the albizia tree on their property. Their continuous efforts allowed the eradication team to identify the most likely position from which to target it.

With a better understanding of the lone bird's behaviour Jesse Friedlander, an experienced avian hunter who was also a member of the original eradication team from 2014 to 2015, was recruited in August, and the team was ably assisted by Verçange Marie of the Seychelles People's Defence Force SPDF). On Wednesday 23rd August, the bird was shot at Morne Blanc, bringing us one step closer to the completion of this momentous eradication. Although the last known bird in the wild has been culled, it is possible that there are more ring-necked parakeets remaining on Mahé and the sixteen months between the bird shot in August 2017 and the one shot in May 2016 are an indication of the difficulty in locating birds in the highly vegetated, mountainous and sparsely populated parts of Mahé.

SIF is extremely grateful to SPDF for their support in the eradication. Without their willingness this eradication project would not have been possible. SIF is also extremely grateful to the Ministry of Employment, Immigration and Civil Status for their assistance, and to the Environment Trust Fund who quickly provided the necessary emergency funding to complete the eradication. A key part of the eradication has been the public information campaign and the information provided by members of the public has been of vital importance at every stage, especially for the last elusive birds to be targeted. At the end of 2017 the bounty remained in place, with no further reports of ring-necked parakeets. Observations will be conducted in 2018 to determine if there are any remaining birds on Mahé or if this invasive alien species can soon be declared eradicated from the country.

Education and Outreach

Education

School activities

In 2017 a total of 752 students in 15 school groups, visited the Vallée de Mai from 13 different schools. For many teachers and students the visit to the Vallée de Mai is one of the highlights of the school year and we are delighted that so many are able to experience this UNESCO World Heritage Site. We will continue to welcome all schools that are interested.

As part of SIF outreach efforts in schools presentations were given in 12 different schools in 2017, reaching over 750 students. Many of the presentations focused on the Seychelles black parrot in an effort to help the students prepare for the black parrot competition held in schools during the year.

Friends of Vallée de Mai club

In 2017 there were 114 children enrolled in the Friends of Vallée de Mai club from all four schools on Praslin (Praslin Secondary, Grande Anse Primary, Baie Ste Anne Primary and Vijay International). This amounts to over 5% of the school children on Praslin, it is fantastic to see many new club members joining each year.

We held a national song and poem competition in schools in 2017 in order to raise the awareness about the Seychelles black parrot. The competition was open to primary and secondary students and asked students to create a poem or song respectively with the theme "Protect the Seychelles black parrot, Seychelles national bird". The competition was open to schools on Mahé, Praslin and La Digue, and there was a high level of participation with 94 poems submitted by primary school students and five of the ten secondary schools in Seychelles participating in the song competition. The judges were amazed by the quality of work that was submitted, and with the level of enthusiasm shown. The winners of the competition were awarded with the opportunity to create a video production of their performances, which were of a very high standard!

These videos can be watched here:
https://www.youtube.com/watch?v=ruKiNZut RmM
https://www.youtube.com/watch?v=13gt EA1Jn2U
https://www.youtube.com/watch?v=o6 LIHF4 UPzU
https://www.youtube.com/watch?v=TjWaRKezlHE

Holiday camp held in August and December

Every August and December during the school holidays, SIF holds a holiday camp programme to teach students about the Vallée de Mai, Aldabra and the environment in general. Common topics include the endemic birds of Seychelles, the flora and fauna of the Vallée de Mai, how to reuse and recycle materials found in the environment, how to grow plants, invasive species and threats to biodiversity. The topics are taught with presentations, outdoor activities like bird watching, and arts and crafts. The August holiday camp was held from the 14th to the 25th August and was attended by 58 enthusiastic students. This was the 11th edition and was special, as in addition to the usual one week holiday camp funded by SIF, the Ministry of Family Affairs provided funding for an extra week of the camp. The Ministry of Family Affairs supported the SIF programme as part of efforts to provide children who may otherwise have been left unattended with a safe and

educational occupation during the holidays. The 12th edition of the SIF Christmas holiday camp programme was held from the 11th to 22nd December for a group of 60 students, as was the case in August, this was a special two-week version of the camp with participants attending either of the weeks.

Eco-Schools trip to Aldabra

Between the 22nd and 24th March 2017, the Eco-Schools Award winners from the previous school year visited Aldabra; the group consisted of 11 lucky students, aged between eight and 16. The students were joined on the trip by five teachers. The trip was sponsored by SIF as the star prize of the national Eco-Schools Award.
The national Eco-Schools Award is coordinated by the Environmental Education Unit at the Ministry of Education. All schools in Seychelles are encouraged to participate by engaging in environmental activities, conduct environmental projects at school and generally adopt more environmentally friendly practices at their school. At the end of the year each school presents the achievements they have made to the judges and the winners for the year are selected.

Upon arrival at Aldabra the students were greeted by the atoll's famous resident blacktip reef sharks up close. A thrilling experience as having grown up on Mahé, most of the students had never seen a live shark. During their stay the students participated in turtle patrols, snorkelling

trips and a lagoon cruise, including a visit to the frigatebird and booby colony at Grande Poche, one of the major seabird nesting colonies on Aldabra. These excursions were undertaken to introduce specific themes; for example, the lagoon cruise covered the theme of discovering the importance of mangroves. The students learned about how many different types of mangroves have overcome the problems of living in a salty environment, often using similar solutions. The students also took part in a clean-up of settlement beach, and soon began making the waste into artwork – adorning the wall of the mess with turtles, sharks, boobies and flamingos. It is a life-changing visit for the students, and an extremely enjoyable week for staff on the atoll.

Outreach

SIF outreach activities in 2017 took place on Mahé, Praslin, Aldabra, online and in New York, reaching a large local and international audience. Highlights included President Faure visiting both Aldabra and the Vallée de Mai, and a group of students representing Aldabra at the UN Ocean Conference in New York. SIF celebrated a large number of theme days and participated in several festivals and expos, sharing Aldabra, the Vallée de Mai and the foundations' work with the public.

Conferences, Festivals, and Expos

Aldabra represented by Seychelles students at the UN Ocean Conference

In June 2017, at the invitation of UNESCO, three Seychellois students represented Aldabra in a World Oceans Day event during the first ever UN Ocean Conference in New York. The three students were Alvania Lawen, Jean- Yves Mancienne and Neil Commettant, they were chosen due to their active participation in the environment related activities at their schools, and were chaperoned by Maria Brioche, SIF's Education and Outreach Programme Officer. At the conference they joined almost 30 other children from 12 different UNESCO Marine World Heritage sites on stage to convince the assembled world leaders to pledge to safeguard our oceans for future generations. During the presentation several of the students, including Alvania, described what the ocean means to them, and made impassioned requests that world leaders commit to protecting the oceans. It was a very proud moment for everyone involved to see the students on stage and Alvania's speech brought tears of joy to members of the Seychelles delegation at the conference which was headed by the Vice-President. The children then unveiled the pledge, titled 'My Ocean Pledge', and then invited world leaders to sign their commitment.

The students have described this opportunity as an experience of a lifetime. Upon their return to Seychelles they reflected:

"It was a proud moment for us all and we felt very important to have been able to get the chance to speak to leaders of the world. Our presence also showed leaders of the world that we are aware of what is happening in the ocean and that it is our future, so they can take the first step to protect it" – Alvania

I really loved the experience. It was a chance of a lifetime. We had a good time over there and saw lots of things, especially in the conference where many points were raised in regards to protecting the environment for future generations" – Jean-Yves

"I am pleased to have got the chance to go to New York. It was a lifetime opportunity. I met other children who have the same interests as me – to protect the environment. I am more determined to work hard for the environment" – Neil

This initiative was hosted by the UNESCO World Heritage Centre Marine Programme and was made possible by the generous support of the Government of Flanders, the Explorers Club, Stefan & Irina Hearst and the Khaled bin Sultan Living Oceans Foundation.

IUCN Massive Open Online Course

In 2017, SIF's work was showcased on a new platform, a Massive Open Online Course (MOOC). The MOOC was hosted on an IUCN MOOC platform, and focused on species conservation in protected areas. MOOCs are online courses aimed at unlimited participation and open access for anyone with internet access. Participants on the MOOC are provided with course materials, including filmed lectures, readings, tests, and interactive user forums to facilitate interactions between participants and their course leaders. The freedom provided by the MOOCs means that users can chose to learn about anything they want, from rocket science to art history, and do these in their own time and at their own pace. SIF contributed several case study videos for use on the platform. The three-minute videos showcased tangible success stories from SIF's conservation of Aldabra and the Vallée de Mai over the past 35 years including the successful re-introduction of the flightless Aldabra rail to Picard Island, the avian eradications on Assomption Island and reversing the unsustainable harvesting trends of coco de mer nuts in the Vallée de Mai. With similar MOOCs attracting up to 11,000 people, we are pleased to be able to showcase SIF's role in protected area management globally.

Festivals

The Seychelles **Sea Turtle Festival** is held in August each year and is organised by the Seychelles Sea Turtle Festival Committee to celebrate the sea turtles inhabiting Seychelles waters and bring together organisations working in sea turtle research and conservation. The 2017 festival was the fifth edition, and this year's revamped event included a march through the heart of Victoria on a busy Saturday morning, attracting a lot of attention from passers-by. The march ended at the old playground with an exhibition set-up for all to enjoy, including multiple sea turtle inspired educational activities. SIF staff took part in the march, and were joined by 12 children from the Friends of Vallée de Mai club, who travelled from Praslin for the event. SIF had a stall at the exhibition, with three main activities for children; 'make your own turtle' from recycled material, turtle conservation themed snakes and ladders, and a pledge board where participants could write their pledge to protect turtles.

Creole festival is one of the most enjoyable events in SIF's calendar of activities. For a week each October special events and activities held all over Seychelles shine a spotlight on the country's traditions and culture. Natural and cultural heritage being intertwined, SIF participates in this national celebration every year, with the aim of sharing Creole culture with visitors to the Vallée de Mai, giving them an opportunity to taste local food and drinks that they may not otherwise experience. In 2017, Creole festival activities took place from the 23rd to 30th October. These activities included traditional dance and song performances, sales of local snacks and drinks, exhibition of antique items, traditional games and a photo exhibition. Amongst the dances performed was the moutya. The moutya is the heart of Seychelles music, and evolved as a way for slaves to express themselves. The moutya has since become one of the Seychelles' most appreciated traditional dances. In the Vallée de Mai a variety of moutya songs were performed by members of the Manglier group. While SIF staff danced and sang along with the moutya band, visitors gathered to observe and take photos, and the more courageous of them joined in! During the week visitors could also watch performances of another popular traditional song, the kanmtole, performed by Vallée de Mai staff. Local snacks and beverages were on sale for visitors to taste, including moukat, nougat and banana cakes. On the last day of Creole festival at the Vallée de Mai visitors could also taste Creole traditional creole dishes. There was also an exhibition of antique household items on display at the visitor centre, the guides accompanying visitors gave explanations and did demonstrations on how the items were used in the past. Senior citizens were present during the festival to demonstrate to visitors how they used coconut leaves to make kapatya bags and hats, amongst many other items that were created from the leaves.

Once again in 2017 SIF participated in the **National Expo** on Eve Island, Praslin on the 24th and 25th June. The SIF stall was designed as a mini replica of the Vallée de Mai, and the SIF team had the honour of providing the coco de mer podium and waterfall backdrop for the official opening of the event. To kick off the Expo, President Faure led the other VIP guests including Vice-President Meriton and designated Minister Mondon through the exhibition at the Vallée de Mai stall. The replica of the Vallée de Mai was conceived to give visitors a taste of the forest, and large palm branches were integrated with existing living trees to create a forest effect. Hidden among the branches and leaf litter were papier-mâché versions of many of the forest inhabitants made by Vallée de Mai staff. The Vallée de Mai team worked extremely hard to create the mini forest and their efforts paid off with the spectacular stall conveying a real sense of the actual UNESCO World Heritage Site. As well as all the foliage and papier-mâché animals there were several educational stations and games around the stall. On display were species specimens from the education room at the Vallée de Mai and many visitors were surprised to discover that there are scorpions in the forest. Younger visitors were delighted with the games on display. There was a question and answer game where participants had to match questions to the right answer by pressing a buzzer and a life-sized version of snakes and ladders had children jumping around at the role of a dice, moving forward after landing on tiles like 'you saved a Seychelles chameleon from yellow crazy ants' and moving backward with dismay after finding out that they had been 'caught off trail'. Children and adults alike spent a long time on the Vallée de Mai treasure hunt, searching for ten hidden snakes in the vegetation. Many visitors had their picture taken with a coco de mer tree.

Communications

SIF's online presence improved drastically in 2017 with several new developments. The Foundation is active on Facebook and Twitter, and as of August 2017 also has an Instagram profile to add to our social media offering. As the environmental organisation in Seychelles with the most social media followers, (7,210 followers on Facebook and 977 on Twitter as of May 2019) these platforms are a wonderful opportunity to share our work locally and internationally.

Also in 2017, after years of planning and development, the new SIF website was launched and is packed with information on SIF, Aldabra and the Vallée de Mai. This will allow viewers a far greater understanding of SIF as an organisation, the two outstanding sites and the work done to protect and preserve them.

The monthly SIF electronic newsletter has been produced and distributed electronically to a mailing list since 2012, but it received a revamp in 2017, with a printable version now being created. The new version is used for archiving on the website and printing limited copies for display in key ministries and tourist establishments. The new printable version will help us reach even more people and will continue to keep all of our supporters up-to-date on SIF news.

VIP Visits

President of Seychelles, Danny Faure

In 2017, SIF was delighted to receive visits from President Danny Faure at both the Vallée de Mai and Aldabra! Since SIF was established in 1979 we have been honoured to have each successive president as our Patron.

President Faure first visited the Vallée de Mai as vice-president and guest of honour at the celebrations for the 30th anniversary of the site's designation as a UNESCO World Heritage Site in 2013, but his visit in February 2017 was his first official visit in his capacity as Patron of SIF. The President was joined on his tour of the Vallée de Mai by the Minister of Environment, Energy and Climate Change, Mr Didier Dogley, SIF board member Mr Victorin Laboudallon and SIF CEO, Dr Frauke Fleischer-Dogley. The delegation was taken on a guided tour of the forest led by Dr Fleischer-Dogley and assisted by the Site Manager. The President described his visit as wonderful and stated that "the youth of our country will need to be educated to take care of and love what God has given us".

In December, Aldabra hosted President Faure, for a four-day familiarising visit. President Faure was joined by a delegation including Minister of Fisheries and Agriculture Pamela Charlette, the

Attorney General Mr Frank Ally and Brigadier Leopold Payet. It has been over ten years since a Patron has visited Aldabra, and the visit was a very special event for SIF! During his visit, President Faure had the opportunity to inaugurate the new cyclone shelter, as well as the Photovoltaic (PV) system which is the first hybrid off-grid system in Seychelles and had recently celebrated five years in operation. On his visit, President Faure and the delegation also had the chance to explore Aldabra, guided by the Chairman Ambassador Loustau-Lalanne, Dr Fleischer-Dogley and the knowledgeable SIF staff. The President enjoyed his time on Aldabra, creating memories that will be cherished forever. He was very impressed with the dedicated team on the atoll and expressed appreciation for the efforts they put into ensuring that the trip was informative and enjoyable, he stated that "the words to describe Aldabra still need to be invented". It was a great privilege to share the atoll with President Faure and his delegation.

Outer Islands Committee of the National Assembly

As part of efforts to familiarise itself with the management of Seychelles' Outer Islands, the Islands Committee of the National Assembly visited Aldabra Atoll. An intense programme to make the most of the one day visit was organised, to ensure that the exceptional beauty and universal value of Aldabra could be fully appreciated by all members of the Islands Committee. The logistical challenges of managing the atoll due to its remoteness, the tides and difficulty of access was experienced first-hand by the visitors when coming in late after visiting the frigate colony, some had to engage in a substantial walk back to La Gigi! During the visit, the formal and informal exchange of information between all members of the group was very enriching. The trip by the members of the Islands Committee is historic since it was the first visit by members of the National Assembly to Aldabra

US Embassy

The US Embassy Chargé d'Affaires, Melanie Zimmerman, and the Consul, Jenn Barr were hosted in the Vallée de Mai in January 2017. The guests learned a great deal about the palm forest ecosystem and were particularly impressed by the gigantic size of the coco de mer leaves, nut and catkins, as well as by the palm-dominated forest canopy which they described as 'amazing' and 'incredible'. They expressed their wish to return to the Vallée de Mai another time and to spend more time exploring and appreciating this unique biodiversity hot spot.

Republic of Mauritius Minister of Foreign Affairs, Regional Integration and International Trade

The Honourable Seetanah Lutchmeenaraidoo visited the Vallée de Mai in February 2017. He was accompanied by his wife Suzanne Lutchmeenaraidoo, counsellor and head of Bilateral III (African and Indian Ocean) Directorate M. H. Chavrimooto and first secretary of the Department of Foreign Affairs Jacques Belle.

EU Ambassador to Seychelles

Ambassador Marjaana Sall paid a short visit to the Vallée de Mai in February. She described her visit as a wonderful experience and said that she will cherish the memories for the rest of her life.

UNAIDS Executive Director

In September, Vallée de Mai staff were delighted to welcome UNAIDS Executive Director Mr Michel Sidibé to the Vallée de Mai. He was accompanied by the Minister for Youth, Sport & Culture Mrs Mitcy Larue, Mr Jude Padayachy, UNAIDS Regional Country Director and Mrs Barbara Barbier, Mr Sidibé's Assistant. The delegation was taken on a guided tour led by the Vallée de Mai Site Manager, where they learned about the biology of the Coco de mer.

Publications

Media (Newspaper and magazine articles)

Seychelles NATION

09/01/2017	No sign of introduced Madagascar fodies on Aldabra promising for eradication success
18/01/2017	VdM Science Coordinator attends workshop on biological invasions in Reunion
13/02/2017	Aldabra reef monitoring a success; tortoise monitoing expanded on Cinq Cases expedition
20/02/2017	President visits Praslin reserves, L'Union Estate on La Digue
03/04/2017	Introduced birds succesfully eradicated from Assumption!
13/06/2017	Seychelles students represent Aldabra at UN Ocean Conference
13/06/2017	Young Seychellois join colleagues to sign pledge to protect the ocean
22/07/2017	New Inva'Ziles project to address invasive alien species threats in Vallée de Mai
24/07/2017	How does Aldabra Atoll fit into the Blue economy of Seychelles?
07/08/2017	Capacity building on Aldabra during south-east season
04/09/2017	Aldabra reclaims title as largest tropical island free of introduced birds
11/09/2017	Praslin pupils learn more about the Vallée de Mai through holiday camp
11/09/2017	Ring-necked parakeet culled at Morne Blanc
28/09/2017	Aldabra experiences first humpback whale beaching

Seychelles News Agency

20/03/2017	Winning students begin explortion of Seychelles' wild and natural Aldabra Atoll
28/03/2017	A trip to remember students recount adventures on Seychelles's Aldabra Atoll
23/04/2017	Popular island safari night-time expedition shows Seychelles' endemic palm forest
25/04/2017	East less parrotfish, save Seychelles' coral reefs? Marine survey indicated a link
02/08/2017	Rising temperatures threaten World Heritage coral reefs, including Seychelles' Aldabra Atoll
04/08/2017	Seychellois student takes Aldabra Atoll experience to UN conference on oceans
08/09/2017	Death of last known ring-necked parakeet a big win in Seychelles' invasive species fight
15/09/2017	Seychelles Islands Foundation to conduct 2-year study of frigatebirds
29/09/2017	2 whales die after beaching themselves on Seychelles' Aldabra Atoll

Kleintiere Schweiz
Petits animaux Suisse
Piccoli animali Svizzera
Animals pitschens Svizra

20/04/2017	Weisser Sandstrand, schwarzer Papegei (White beach, black parrot)

Scientific publications in 2017 (peer-reviewed articles)

Aldabra

Haverkamp PJ, Shekeine J, de Jong R, Schaepman M, Turnbull LA, Baxter R, Hansen D, Bunbury N, Fleischer-Dogley F, & Schaepman-Strub G. (2017) Giant tortoise habitats under increasing drought conditions on Aldabra Atoll—Ecological indicators to monitor rainfall anomalies and related vegetation activity. Ecological Indicators 80: 354–362.

Santamaria CA, Bluemel JK, Bunbury N, & Curran M. (2017) Cryptic biodiversity and phylogeographic patterns of Seychellois Ligia isopods. PeerJ 5: e3894.

Vallée de Mai

Maddock S, Wilkinson M, Nussbaum R & Gower D. (2017) A new species of small and highly abbreviated caecilian (Gymnophiona: Indotyphlidae) from the Seychelles island of Praslin, and a recharacterization of Hypogeophis brevis Boulenger, 1911. Zootaxa 4329: 301–326.

Morgan EJ, Kaiser-Bunbury CN, Edwards PJ, Fleischer-Dogley F, Kettle CJ (2017) Keeping it in the family: strong fine-scale genetic structure and inbreeding in Lodoicea maldivica, the largest-seeded plant in the world. Conservation Genetics 18:1317–1329.

Morgan EJ, Kaiser-Bunbury CN, Edwards PJ, Fleischer-Dogley F & Kettle CJ. (2017) Tracing coco de mer's reproductive history: pollen and nutrient limitation reduce fecundity. Ecology & Evolution 7:7765–7776.

Rocha S, Perera A, Bunbury N, Kaiser-Bunbury CN, & Harris J. (2017). Speciation history and species-delimitation within the Seychelles bronze geckos, Ailuronyx spp.: molecular and morphological evidence. Biological Journal of the Linnean Society 120: 518–538. (doi: 10.1111/bij.12895).

Biological Journal of the Linnean Society, 2017, **120**, 518–538. With 7 figures.

Speciation history and species-delimitation within the Seychelles Bronze geckos, *Ailuronyx* spp.: molecular and morphological evidence

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Research on the genetic variability across various organisms from the Seychelles granitic islands has revealed considerable differentiation within many taxa, often with deep evolutionary lineages, likely corresponding to cryptic species. Although an accurate description of insular diversity is important for biogeographical and conservation reasons, there is frequently a lack of information even for presumably better known groups, such as vertebrates. One example is the endemic genus *Ailuronyx*, which includes the emblematic Seychelles giant bronze gecko *Ailuronyx trachygaster*. In the present study, we investigate, for the first time, based on morphological and molecular information, the intraspecific diversity of the three currently recognized *Ailuronyx* species, and reassess their distribution and history of diversification. Our data clearly indicate an old (Miocenic) divergence between these species, as well as the existence of cryptic diversity within *Ailuronyx seychellensis*, and, to a lesser extent, within *Ailuronyx tachysopaeus*, that should be further explored and described. Preliminary data suggest concordant patterns of morphological and molecular differentiation. The results also show that, although morphological discrimination between the currently described species is possible, some previous distribution records based on observations may be wrong, which is important for conservation management. The observed genetic structure patterns are congruent with those of other endemic taxa from the Seychelles, again highlighting the evolutionary importance of historical fragmentation across this ancient archipelago, the existence of overlooked diversity, and the need for detailed morphological and genetic assessments to accurately identify and address conservation priorities. © 2016 The Linnean Society of London, *Biological Journal of the Linnean Society*, 2017, **120**, 518–538.

KEYWORDS: *Ailuronyx* – C-*mos* – cyt *b* – morphometrics – phylogeography – RELNint61 – Seychelles.

INTRODUCTION

Compared with mainlands, islands contain a disproportionate amount of biodiversity (Kier *et al.*, 2009) while their endemic taxa often exhibiting also disproportionate degrees of phenotypic diversification (Losos & Ricklefs, 2009; García-Porta *et al.*, 2016), and, as such, they are increasingly recognized as high conservation priorities (Brooke, Hilton & Martins, 2007). To identify and implement conservation actions, accurate data on biogeographical patterns, genetic diversity, and taxonomic status are needed, especially for vertebrate taxa, which are commonly targeted in conservation programmes. As a result of their long isolation history (approximately 65 Myr) and geography, the granitic islands of the Seychelles archipelago host a rich assemblage of endemic species (Stoddart, 1984;

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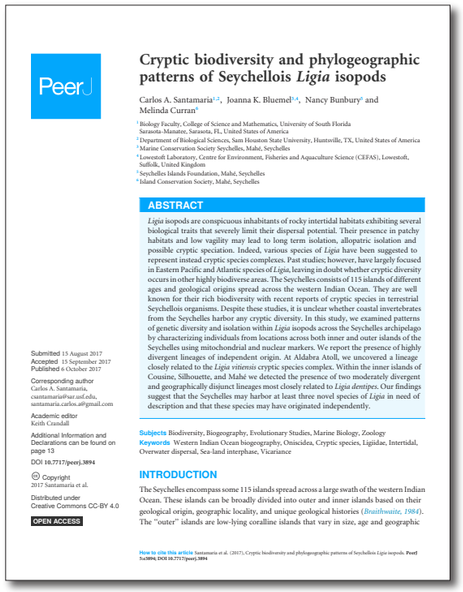

PeerJ

Cryptic biodiversity and phylogeographic patterns of Seychellois *Ligia* isopods

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Additional Information and Declarations can be found on page 13

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OPEN ACCESS

ABSTRACT

Ligia isopods are conspicuous inhabitants of rocky intertidal habitats exhibiting several biological traits that severely limit their dispersal potential. Their presence in patchy habitats and low vagility may lead to long term isolation, allopatric isolation and possible cryptic speciation. Indeed, various species of *Ligia* have been suggested to represent instead cryptic species complexes. Past studies; however, have largely focused in Eastern Pacific and Atlantic species of *Ligia*, leaving in doubt whether cryptic diversity occurs in other highly biodiverse areas. The Seychelles consists of 115 islands of different ages and geological origins spread across the western Indian Ocean. They are well known for their rich biodiversity with recent reports of cryptic species in terrestrial Seychellois organisms. Despite these studies, it is unclear whether coastal invertebrates from the Seychelles harbor any cryptic diversity. In this study, we examined patterns of genetic diversity and isolation within *Ligia* isopods across the Seychelles archipelago by characterizing individuals from locations across both inner and outer islands of the Seychelles using mitochondrial and nuclear markers. We report the presence of highly divergent lineages of independent origin. At Aldabra Atoll, we uncovered a lineage closely related to the *Ligia vitensis* cryptic species complex. Within the inner islands of Cousine, Silhouette, and Mahé we detected the presence of two moderately divergent and geographically disjunct lineages most closely related to *Ligia dentipes*. Our findings suggest that the Seychelles may harbor at least three novel species of *Ligia* in need of description and that these species may have originated independently.

Subjects Biodiversity, Biogeography, Evolutionary Studies, Marine Biology, Zoology
Keywords Western Indian Ocean biogeography, Oniscidea, Cryptic species, Ligiidae, Intertidal, Overwater dispersal, Sea-land interphase, Vicariance

INTRODUCTION

The Seychelles encompass some 115 islands spread across a large swath of the western Indian Ocean. These islands can be broadly divided into outer and inner islands based on their geological origin, geographic locality, and unique geological histories (*Braithwaite, 1984*). The "outer" islands are low-lying coralline islands that vary in size, age and geographic

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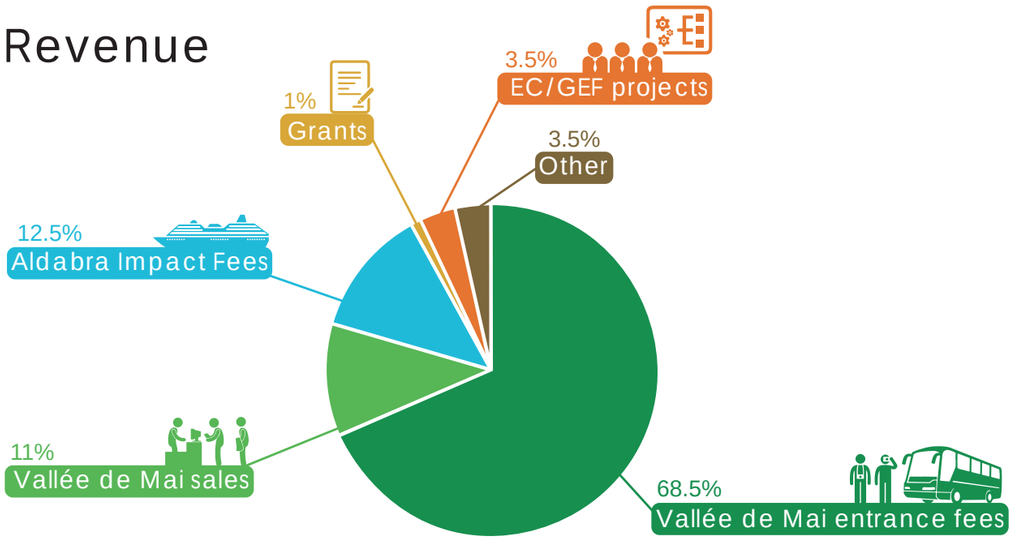
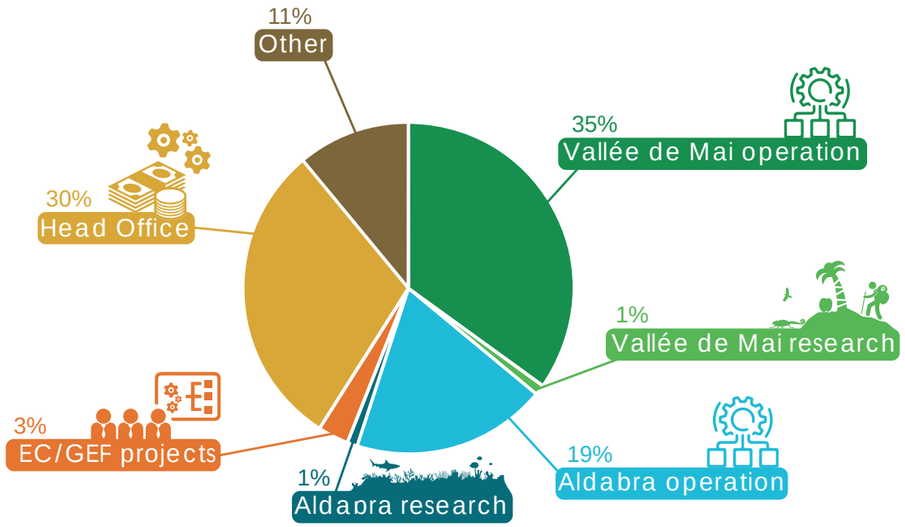
Financial information

2017 marks the first year that the Vallée de Mai entrance fees' contribution towards SIF revenue is proportionally less than 70%, however the revenue earned from additional services to our visitors in the souvenir shop and café remained at 11%. Considering the increase in visitors this means that our services are well appreciated and in line with visitor expectations. Compared to 2016 double the amount of project funding and grants was raised this year, which allowed us to increase our expenditure substantially, allowing us to continuously implement our projects and increase our research activities. In addition, the expenses incurred for Aldabra's operations could also partially absorbed by project funding and therefore reduced by 9%. However with an increase in project funds the project management and administration at the head office had to be strengthened and increased the overall head office costs by 5%.

Revenue



Expenditure



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Sales Clerks: Kimberley Accouche, Michelle-Anne Adonis, Irina Barbe (Housekeeper), Marie-Paul Bistoe, Stephanie Dugasse, Kimberley Hall, Kathleen Ladouce, Christelle Nibourette, Menda Rose, Clasha Serret, Fannia Suzette, Missia Dubignon, Netifa Esther, Hillary Lucas, Nelsonne Etienne
Trainee Ranger: Cheyenne-Mae Chang-Yunn, Emmanuel Morrel, Shanone Hibonne
Assistant Administrative and Accounts Officer: Veronica Souyana, Elsa Lesperance
Senior Visitor Attendant: Medina Laboudallon
Visitor Attendants: Stephanie Rose, Brina Zialor
Security Officers: Terry Asba, Andy Nourrice, Andrea Radegonde, Emmanuel Valentin, Daniella (Mousbe) Florentine
Housekeeping: Anna Savy, Antoinette Vinda
Fieldworkers: Tessa Athanase, Elvis Labrosse, Andy Loze, Marie-Andre Radegonde, Gerry Rose, Nelsona Etienne, Alvin Lewis
Senior Ranger: Terance Payet
Inva'Ziles Project Coordinator: Sarah Atkinson
Inva'Ziles Project Officer: Sascha Dueker
Black Parrot Data Officer: Julia Kovacs
Black Parrot Volunteer: Sascha Dueker
Praslin IAS Project Officer: Vicky Stravens
Invasive Species Technical Officers: Shanone Adeline
MSc student and Senior Field Research Officer: Chris Tagg
PhD student: Emma Morgan (ETH Zurich)
Volunteers: Willow West, Paul Suzette, Julia Marie

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Alexander Müller

Our partners and associates

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Seychelles Fishing Authority
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Islands Development Company
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Seychelles National Meteorological Service

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SIF in a nutshell and how to help

The Seychelles Islands Foundation (SIF) is a non-profit charitable organization which was established as a Public Trust in 1979 to manage, protect, research and promote sustainable ecotourism in the Seychelles' two UNESCO World Heritage sites of Aldabra Atoll and the Vallée de Mai on Praslin. A major focus is on scientific research to support and improve conservation management of the unique biodiversity and ecosystems of these two very different sites.

To successfully operate and protect two World Heritage sites, which are more than 1000km apart and each with their specific set of challenges, SIF relies primarily on income generated by entrance fees and sales from the Vallée de Mai. This is supplemented by project funding, grants and donations. Aldabra provides some direct income through visitor impact fees but piracy activities have reduced this source of revenue. SIF's management and work at these sites will continue to be dependent on visitor numbers and the generosity of our supporters for the foreseeable future.

There are a number of ways in which you can help us with this work:

- Visit the Vallée de Mai any day of the year and experience the magic of this unique site for yourself
- Purchase SIF products and souvenirs directly from the Vallée de Mai shop or the SIF Head Office in Mont Fleuri, Victoria
- Stop at the Vallée de Mai cafeteria and support local Praslinois producers and suppliers
- Tell other people about SIF and our work
- Volunteer or work for SIF – depending on active projects, there may be volunteer or employment opportunities for suitably qualified international volunteers to help with research, conservation work or specific projects for 4-6 month periods – check our website for vacancies.

If you would like to contribute, receive more information or are interested in receiving further news about SIF via monthly e-newsletters please sign up on the home page of our website or contact us by email at info@sif.sc.

aldabra atoll seychelles islands foundation vallée de mai

Seychelles Islands Foundation

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