



Plate 1. Four Greater-crested Tern chicks unable to fly at water edge of the new emerged sandbank, facing Ile aux Goëlettes, April 2017. © Aurélie Duhec

Breeding seabirds of Farquhar Atoll, Seychelles including the return of two species: Red-footed Booby *Sula sula* and Greater-crested Tern *Thalasseus bergii*

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Introduction

Farquhar Atoll is situated 770 km south-southwest of Mahé (the main island of Seychelles) and 270 km northeast of Madagascar. It is a low-lying flat, roughly circular atoll of ten islands surrounding a shallow lagoon, which dries extensively at low tide (Figure 1). Beyond Farquhar Atoll, the nearest islands are Saint-Pierre and Providence Atoll, both situated to the north. Together these islands make up the Farquhar Group, one of the four main island groups of Seychelles, three of which are collectively known as the Seychelles outer islands (Figure 2).

Farquhar was discovered in 1504 and named in honour of Portuguese navigator Joao de Nova. The first chart was produced by French hydrographer Margaro in 1776. The atoll was renamed in 1824, in honour of Sir Robert Townsend Farquhar, Governor of Mauritius 1810–1823. In 1813, Governor Farquhar awarded the lease of Farquhar to Monsieur Boudet, a resident of Mauritius, probably the first proprietor of the atoll. He and subsequent proprietors made money from produce including coconuts, dried fish, maize and guano. There is no information available on the state of the island ecosystem before human settlement. However, the presence of substantial seabird colonies on the main islands is attested by the presence of guano and phosphatic rocks (Baker 1963). The decline of seabird populations doubtless commenced soon after human settlement.

The first published observations from Farquhar were those of Fairfax Moresby in March 1822, but these were limited to the concerns of the day, being mainly fixing the position of little known islands, shoals and anchorages (Moresby 1842). The first published observations of seabirds were by Robert Farquhar's namesake, Commander Stuart Farquhar in 1897 (Farquhar 1900). Little else was recorded concerning flora and fauna until the Percy Sladen Expedition in 1905, when Stanley Gardiner worked mainly on the seaward reef of Ile du Nord while entomologist Bainbrigg Fletcher worked on Ile du Sud, but no significant observations of breeding seabirds were made at this time (Gardiner and Cooper 1907). Vesey-Fitzgerald made observations of seabirds in 1937 (Vesey-Fitzgerald 1941). Stoddart and Poore summarised early information collected on birds (Stoddart and Poore 1970).

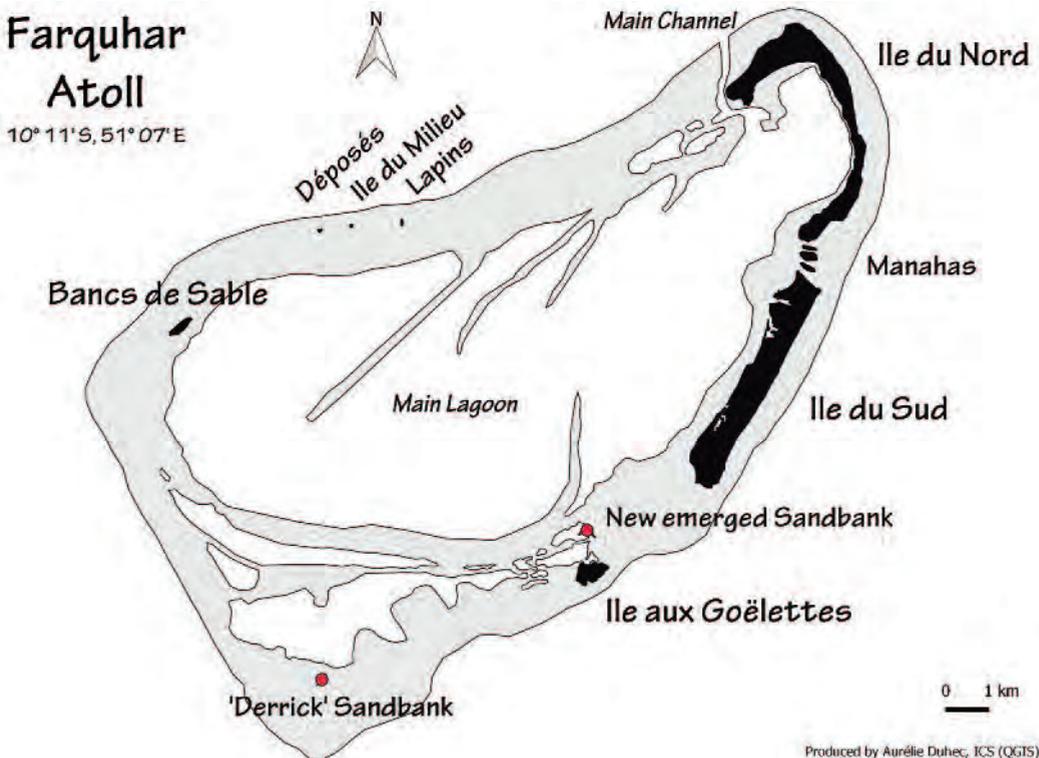


Figure 1. Map of Farquhar.

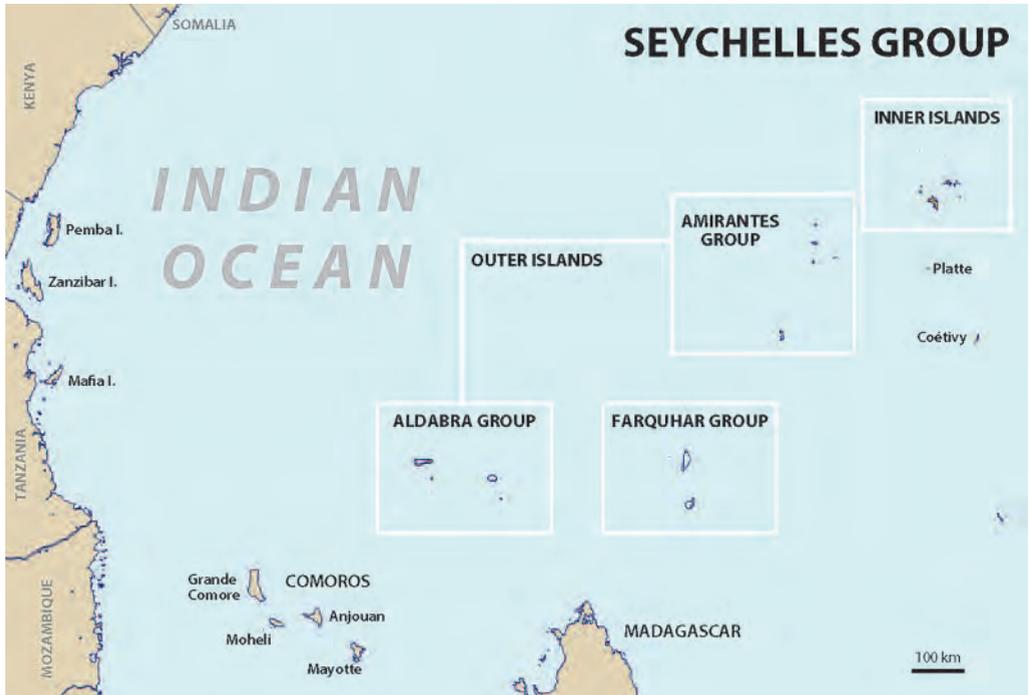


Figure 2. Map of Seychelles including the Farquhar Group (from Skerrett and Disley 2011).

The lease of Farquhar was passed to the Mahé Assets Company in 1924, to Dr. Lanier in 1936 and to Paul Moulinie in 1951. In 1965, Farquhar became a part of British Indian Ocean Territory (BIOT). Upon independence in 1976, Farquhar was returned to Seychelles by BIOT for the nominal fee of 30 rupees.

In September 2014, the Island Conservation Society (ICS) established a Conservation Centre at Farquhar, with Aurelié Duhec (AD) as Conservation Officer and Richard Jeanne (RJ) as Assistant Conservation Officer. This was made possible thanks to financial support for an initial period of five years under the Outer Islands Project (OIP), a project funded by the Government of Seychelles (GOS), United Nations Development Programme (UNDP) and Global Environment Fund (GEF) with the assistance of the Islands Development Company (IDC), managers of Farquhar Atoll.

The OIP project will lead to the creation of terrestrial and marine protected areas on Farquhar, Alphonse Group, Desroches, and Poivre. On Farquhar Atoll, the protected lands will consist of Ile du Sud (National Park, IUCN Category II), Ile aux Goëlettes and Bancs de Sable (Strict Nature Reserves, IUCN Category I). The OIP identifies seabirds as an important component of the outer island ecosystems and an important feature of the proposed protected areas (PIMS 4529 Seychelles Outer Islands 2013).

Farquhar as an IBA

Five of the smaller islets of Farquhar Atoll are collectively recognized by BirdLife International as an Important Bird Area (IBA). There are twenty IBAs in Seychelles as a whole. Most of the eleven IBAs of the inner islands are recognised due to the presence of endemic land birds. However, in seven of the nine IBAs in the outer islands, IBA status rests entirely upon the importance of seabird populations. Farquhar qualifies as

an IBA under Category A4i (a site containing 1% or more of the African region population of a congregatory waterbird species, the definition including seabirds). Three seabird populations within the existing boundaries of the Islets of Farquhar IBA exceed A4 thresholds: Brown Noddy *Anous stolidus*, Sooty Tern *Onychoprion fuscatus* and Black-naped Tern *Sterna sumatrana*. Farquhar also qualifies under Category A4iii (a site that holds more than 20,000 waterbirds of all species). Excluded from the IBA are the two largest islands, Ile du Nord and Ile du Sud, together with three smaller intervening islands known as the Manahas (Skerrett and Rocamora 2001).

The islands within the Islets of Farquhar IBA that have the greatest ornithological interest are Ile aux Goëlettes and Bancs de Sable. Ile aux Goëlettes is the most southerly point of land in Seychelles and hosts five of the atoll's eight breeding seabird species: Sooty Tern, Brown Noddy, Lesser Noddy *Anous tenuirostris*, Roseate Tern *Sterna dougallii* and Black-naped Tern. Bancs de Sable is the youngest of the 155 islands named in the Constitution of Seychelles, first noted only in the 1950s when residents reported a new small sandbank with two or three shrubs (Skerrett 2006a and 2006b). By 1963 it was a small island of no more than 30 square metres at high tide with a few very low *Scaevola sericea* and one very small coconut tree (G Gendron pers comm.). Today it measures approximately 10.6 ha (AD and RJ pers comm). A colony of Black-naped Terns breeds here.

The final three seabird species breeding at Farquhar are Fairy Tern *Gygis alba* breeding throughout the atoll (excluding Ile aux Goëlettes), Red-footed Booby *Sula sula* and the recently rediscovered Greater-crested Tern *Thalasseus bergii*. These two last species are discussed in detail below.

Historical confusion on the status of the Greater-crested Tern

In 1937, Vesey-Fitzgerald recorded that Greater-crested were 'seen around most of the islands'. However, in the whole of Seychelles he only observed breeding activity at African Banks and he made no specific mention of Farquhar at all (Vesey-Fitzgerald 1941). In 1970, Stoddart and Poore summarised ornithological observations at Farquhar, stating that Parker observed the presence of Greater-crested Tern at Farquhar in 1967 but curiously, Parker himself omits the species from his own list of seabird observations from this same time and published in the same journal (Stoddart and Poore 1970, Parker 1970).

Stoddart and Poore overlooked any mention of the observations of Cdr Farquhar in 1897. These are important, but somewhat incongruously Cdr Farquhar reported Royal Tern *Sterna maxima* breeding at Ile aux Goëlettes (Farquhar 1900). For the purposes of publication, the Editor of *Ibis* changed the published reference to "Great Sea-Tern (*S. bernsteini* [?])" noting correctly that *S. maxima* is unlikely as it is mainly an American species. However, the Editor's choice is equally unlikely as Chinese Crested Tern *Thalasseus bernsteini* (formerly *S. bernsteini*) is a Critically Endangered species, previously thought extinct until four pairs were discovered in 2000 on an islet in the Matsu Islands (Taiwan); it formerly had a wider range off the Chinese east coast but it is unknown in the Indian Ocean. The Editor of *Ibis* further speculated in a footnote that "*S. bergii*" (Greater-crested Tern) was a possibility (Farquhar 1900). This speculation is almost certainly correct, and if so it is the earliest record of Greater-crested Tern breeding at Farquhar.

The absence of any records after 1867 suggests Greater-crested Tern probably disappeared as a breeding species at Farquhar at an unknown date. It was observed

present on most islands in significant numbers 1959–1963 but no nesting activity was noted during this period (G Gendron pers comm). Ornithological observations from Farquhar were published relating to 1937, 1967, 1976, 1996, 2005, 2006 and 2011, (Vesey-Fitzgerald 1941, Stoddart and Poore, 1970, Parker 1970, Feare 1976; Skerrett 1996; Skerrett 2006a, Skerrett and Rocamora 2007; Nahaboo 2011) but none recorded breeding activity of Greater-crested Tern, only the presence of non-breeding birds. However, interviews with former residents supported by photographic evidence reveal that the species certainly bred at Farquhar in 2001 and probably most years up to 2011.

AD and RJ interviewed IDC Staff once resident at Farquhar. In an interview with George Marie, IDC Island Manager on Farquhar 1999–2004, he said that Greater-crested Tern was breeding in ‘good numbers’ at Bancs de Sable in 2001 (confirmed by a photograph of two chicks). In a further interview, Elvis Stravens, IDC Island Manager 2004–2011, confirmed breeding activity during this period but was unable to confirm if this was an annual event. All observations were made on Bancs de Sable. This paper is the first published account of Greater-crested Tern to confirm breeding at Farquhar and it increases the number of nesting seabirds from seven to eight.

Cyclone Fantala and the return of the Greater-crested Tern

In April 2016, Cyclone Fantala, the most powerful cyclone ever recorded in the western Indian Ocean, struck Farquhar Atoll. Almost all infrastructure except the cyclone shelter and over 90% of coconut trees were destroyed. Storm surge and overwash of sand and coral rubble brought coastal accretion to parts of Ile aux Goëlettes, while the southern coast of Ile du Sud was degraded. Sandy material and rubble were transported to the sandy reef flat between Ile du Sud and Ile aux Goëlettes. This new input of sand raised an existing tidal sandbank above spring high tide to produce a new island, first observed by Steve Vandayne in May 2016. This bank had been progressively growing since about 2013 (Garry Azemia pers comm) but was covered at high tide previous to Cyclone Fantala.

On 18 April 2017, AD and RJ landed on the new sandbanks to record their contours and area. The aggressive territorial behaviour of a few Greater-crested Terns alerted them to possible breeding activity. Among a roosting colony of 100 adults and 4 juveniles they saw four chicks unable to fly. Chicks were well feathered but with down remaining on their foreheads (Plate 1). A fifth chick was observed that had recently fledged judging by its weak attempts at flight.

Given that incubation is 25–30 days and chicks fledge after 38–40 days, it is estimated that the laying event occurred in the beginning of February. This laying period coincides with the period observed at Bancs Providence (Skerrett 2016a). It is possible that the Farquhar nesting population was a little larger than five pairs and the chicks observed might be the last of the breeding season. However, the limited surface available, 4,070m² at high tide, suggests a small colony. The ICS team has suggested the newly emerged sandbank should be named Ban Golan Sardin (Creole for ‘Greater-crested Tern Bank’).

Prior to this observation and since their arrival at Farquhar in September 2014, AD and RJ had only observed non-breeding adult and fledged juvenile Greater-crested Terns, with a maximum count of 131 birds in May 2015. Their favourite roosting sites were Bancs de Sable and a tidal sandbank in the extreme south of the atoll in an area named ‘Derrick’ by the IDC fishermen (Duhec 2015b). This sandbank formed



Plate 2. The Greater-crested Tern colony roosting on the new emerged sandbank, May 2017. © Richard Jeanne

around 2011–12 (Garry Azemia pers comm). It was named by IDC fishermen because the location is marked by the crane of a shipwreck visible above the surface, the superstructure of the vessel lying in waters up to about 8 metres in depth. It has been regularly monitored by AD and RJ. It changed in shape following Cyclone Fantala but did not receive sufficient sand deposits to remain emerged at high tide, unlike the new breeding site.

A leucistic juvenile, recognisable from its distinctive plumage, was observed with adults in October 2014 and again in February 2015 (Duhec 2015a) which suggests birds regularly travel from another breeding island, most likely Bancs Providence, only 60 km north of Farquhar.

Elsewhere, the largest known colony of Greater-crested Tern in Seychelles with a minimum of 250 pairs was discovered at Bancs Providence only in 2016 (Skerrett 2016a). Breeding has also been recorded at Aldabra (Diamond and Prÿs-Jones 1986), Etoile (Islands Development Company archive, photographer unknown, in Skerrett 2016a), African Banks (Vesey-Fitzgerald 1941; Feare 1979). The current status at Etoile and African Banks is uncertain because of a lack of recent observations; breeding may also occur at Astove and Cosmoledo but these are not confirmed (Skerrett 2016a).

Greater-crested Tern is vulnerable to disturbance. At Aldabra, colonies have even abandoned small chicks and eggs when scientists have attempted to study the birds while exercising some (but evidently not sufficient) caution (Diamond and Prÿs-Jones 1986). Natural predators too take their toll at tern colonies and in 2015 at Bancs de Sable AD and RJ recorded the desertion of the nesting site by Black-naped Terns due to evident predation by Grey Herons *Ardea cinerea* (Duhec and Jeanne 2016). The species was monitored through three nesting seasons (Nahaboo, 2011; Duhec,

2016) and was found to have shifted location. While the birds were mainly originally recorded nesting on open beach platforms clear of vegetation, in 2015 a breeding attempt occurred inland surrounded by coastal shrubs, which is an atypical habitat. It is possible that Greater-crested Tern abandoned Bancs de Sable some years ago because of human disturbance and Grey Heron predation. They may have moved to Bancs Providence, the closest nesting site from Farquhar. Bancs Providence is rarely visited by humans although it has a very large Grey Heron population.

The decline and rise of Booby populations

In July 1897, three species of booby bred at Farquhar. Large numbers of Red-footed Booby nested in shrubs and trees on Ile du Nord and Ile du Sud, while Masked Booby *Sula dactylatra* and Brown Booby *S. leucogaster* both nested on the ground at Ile aux Goëlettes (Farquhar 1900).

Extinction of Masked Booby and Brown Booby

At the time of the next ornithological visit in September/October 1937, Masked Booby survived as a breeding species at Ile aux Goëlettes but no Brown Booby were reported (Vesey-Fitzgerald 1941). By 1959 there were no boobies breeding at Ile aux Goëlettes. However, both species were known by residents of Farquhar to breed at Ile du Milieu, Lapins and Déposés during 1959–1963 (G Gendron pers comm). During this period it was known that workers would take birds for food, but the lessee, Paul Moulinie, protected the colony by imposing a fine of 20 rupees should any bird be killed (G Gendron pers comm). The basic wage of the day was 150 rupees per week.

In October 1976 Feare was informed by residents of Farquhar that Masked Booby still nested at Ile aux Goëlettes but were taken by residents for food. He found no evidence to support this, such as nests or guano encrusted nesting areas, but found four nests of Brown Booby at Lapins and noted birds flying over Ile du Milieu and Déposés (Feare 1978). That same year, the UK Government passed sovereignty of Farquhar from BIOT to the Government of Seychelles. No protection was given to any breeding seabirds then and Brown Booby disappeared as a breeding species some time thereafter. The species has been rarely sighted at Farquhar, but two recent sightings in June and July 2017 and the recent recolonisation of Boudeuse (480 km NNE of Farquhar) give hope for their potential return (Rocamora 2014, Skerrett 2016b).



Plate 3. Nesting Red-footed Booby in the southern Barachois dominated by *Pemphis acidula*. View from the high non active dunes at Ile du Sud, May 2017. © Aurélie Duhec

In summary, Brown Booby was known to breed at Ile aux Goëlettes in 1897, but subsequently disappeared. Brown Booby bred at Ile du Milieu, Lapins and Déposés until at least 1963, continuing at Lapins until at least 1976. Masked Booby bred at Ile aux Goëlettes until at least 1937 and at Ile du Milieu, Lapins and Déposés until at least 1963. Extinctions were almost certainly due to birds being taken for food.

The near extinction and dramatic revival of Red-footed Booby

There are no breeding records of Red-footed Booby on Ile du Nord after 1897, their extinction due doubtless to the fact this island has long been the centre of human settlement and coconut plantation. Ile du Sud also suffered considerable losses but small numbers continued to nest high in Casuarina trees (Travis 1959; Stoddart and Poore 1970). In October 1976 44 nests were recorded and the colony was suspected to be larger from the evidence of guano stained trees (Feare 1978). However, in 1996 the colony apparently suffered still further decline to just six pairs, also high in Casuarinas (Skerrett 1996). Subsequent visits suggested a steady increase in numbers though no full survey was conducted until the arrival of ICS staff in 2014. In 2015, up to 4,200 pairs were recorded (Duhec and Jeanne 2015b) during the peak of breeding activity.

At first sight, the devastation wrought by Cyclone Fantala appeared to be a setback for the colony (Plates 3 and 4). The cyclone struck at the height of the breeding season when there were many birds with nests containing eggs or chicks. All nests were destroyed together with virtually all Casuarina trees where birds nested. However, despite the write-off of that season, adults appeared to have survived well and returned in the highest ever recorded numbers, adapting well to the lower available nesting sites. AD and RJ estimated the population at 8,776 (+/- 1,221) pairs in 2017. This is well beyond the A4ii IBA threshold of 10,000 individuals.

This spectacular increase in Red-footed Booby numbers, first documented during the 2015 breeding census, suggests a very high breeding success, and in addition the presence of white-tailed brown morph that do not breed anywhere else in Seychelles (2% of the population in 2015) (Plate 5) suggests an influx of birds from other rookeries most probably attracted by the abundance of prey around Farquhar (Duhec and Jeanne 2015b). Le Corre concluded that Indian Ocean populations are genetically isolated from each other (Le Corre 1999). White-tailed brown morph breeds elsewhere in the region at Tromelin and Europa. Tromelin lies 720 km southeast of Farquhar, considerably closer than Europa, which is about 1,800 km via the shortest sea route roughly southwest of Farquhar. This suggests Tromelin might be the most likely source of white-tailed brown morph colonisers. On the other hand, the Tromelin colony is very small, with just 130–180 pairs of which only one third are white-tailed brown morph whereas the Europa colony is considerably larger at 2,800–3,800 pairs of which 98.5% are this morph (Le Corre 1999).

AD and RJ have found the ecosystem of Farquhar to be remarkably interesting. During 2015, when the Indian Ocean Dipole and El Niño coincided, record high sea surface temperatures over the Indian Ocean led to low breeding success of seabirds throughout Seychelles except at Farquhar, where there was no apparent food shortage. The rich waters of Farquhar are probably due to a combination of factors including numerous underwater canyons and the existence of nearby seamounts which contribute to eddies and upwelling of highly productive waters, and all these oceanographic phenomena are enhanced by the passage of the west-flowing South Equatorial Current (Duhec and Mortimer 2017).



Plate 4. Red-footed Boobies nesting in *Pemphis acidula*. This shrub became the favourite nesting habitat of the species after the destruction of *Casuarina* trees by Cyclone Fantala, May 2017. © Aurélie Duhec



Plate 5. A white-tailed brown morph with a downy chick nesting in a *Casuarina* tree, the favourite habitat of the seabird species before the cyclone Fantala, October 2014. © Richard Jeanne

Other Seabirds

On 10 July 1897 Cdr Stuart Farquhar reported a colony of Roseate Terns *Sterna dougallii*, some with one, two or even three eggs and a few with chicks (Farquhar 1900). Later visits by ornithologists were rare or non-existent outside the relatively short breeding season of this species but more than a century after Cdr Farquhar's visit on 25 June 1999, Roseate Terns were reported again with 50 birds present (Skerrett 1999). Breeding was confirmed in 2005 (Skerrett and Rocamora 2007). The colony remains small and fragile, estimated at 67 pairs in 2015 (Duhec and Jeanne 2015a).

Black-naped Tern *Sterna sumatrana* bred at Ile aux Goëlettes in 1937 (Vesey-Fitzgerald 1941). It was confirmed as a breeding species at Farquhar on 25 February 2006 when 14 nests with eggs were discovered at Bancs de Sable (Skerrett 2006b). The species was subsequently found also to continue to breed at Ile aux Goëlettes and the atoll-wide population was estimated at 87–137 pairs (Duhec and Jeanne 2016). This is by far the largest population in Seychelles, which hosts all known colonies in the African region with an estimated total population of 245–345 pairs (Skerrett 2016a).

In terms of numbers, the most common seabird at Farquhar is Sooty Tern *Onychoprion fuscatus*, estimated at 280,600 pairs (+/- 21,169 pairs) in 2017, followed by Brown Noddy with about 19,139, (+/- 2649 pairs) in 2017. Both results are similar to the 2015 census figures. Lesser Noddy *Anous tenuirostris* is a recent colonizer, first recorded in 2011 with a total of 10 nests and with a nesting population of about 40 pairs in 2015, reduced to about 30 pairs in 2017.

Fairy Tern *Gygis alba* breeds throughout the atoll, excluding Ile aux Goëlettes, with up to 500 pairs in 2015, but the population declined after Cyclone Fantala to about 100 pairs in March 2017. The species is mainly found on Ile du Nord.

Recommendations

Seabirds are important indicators of climate change and the health of the oceans and Farquhar Atoll is one of the most important seabird sites in the Indian Ocean. It is therefore important to establish a funding mechanism to continue the long-term monitoring of seabirds at Farquhar Atoll beyond the lifetime of the OIP, which will expire in 2019. ICS operates Conservation Centres at Alphonse and Desroches with plans to open a further centre at Poivre. Alphonse and Desroches Conservation Centres are funded mainly by conservation levies on each tourist visitor to the islands, together with direct subsidies from IDC and other contributions. Endowment Funds have been established with a UK investment company to provide further long term financial security to conservation activities. While tourist visitors to Farquhar are fewer in number, limited to small groups of mainly fly-fishermen, similar mechanisms should be sought to support the continuation of conservation activities.

Visits to tern breeding sites should be limited in order to minimise disturbance. During the breeding season there should be no visits except for the purposes of monitoring from a safe distance, possibly by deploying a drone to photograph from afar without alarming nesting birds. ICS and IDC should collaborate to ensure that there are no unsupervised landings whatsoever at either Bancs du Sable or the newly emerged island where Greater Crested Terns have bred.

The growth in the number of breeding Red-footed Boobies lends powerful support to the recent recommendation that the boundaries of the Islets of Farquhar IBA should be extended to encompass the whole of Farquhar Atoll (Millett *et al.* 2016). In 2001,

Ile du Sud was excluded from the IBA designation as it contained just a small number of breeding seabirds, but the subsequent dramatic expansion of the colony of Red-footed Booby means that Farquhar Atoll now holds populations of four seabird species that exceed Category A4i and this fourth species breeds entirely outside of the Islets of Farquhar IBA. The new boundary incorporating Ile du Sud in particular is consistent with the Government of Seychelles' recognition of Ile du Sud as a National Park, IUCN Category II.

A regional DNA study should be initiated to investigate the origin of Red-footed Boobies including at Farquhar and the relationship between different regional colonies. At Farquhar this would include some white-tailed brown morph birds which have apparently come from a colony or colonies outside Seychelles. Ideally, the study should encompass collection of samples from colonies at Aldabra, Cosmoledo, Marie Louise, Europa and Tromelin.

It is critical to understand the foraging areas of seabird species breeding at Farquhar Atoll, particularly the Red-footed booby and Sooty Terns, in order to conserve them. A seabird tracking programme should be developed.

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