

# The Seychelles - twenty years of seabird research and monitoring

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(All photographs by the author)

## Abstract

Twenty years ago, a new NGO was formed in Seychelles, Islands Conservation Society (ICS) and today it has five conservation centres spread throughout the islands, coordinated from a Head Office on Mahé. A key area for monitoring and research has been seabird populations, and some previously unknown seabird populations have been discovered. However, data gathered to date indicates concerns regarding population trends. Many populations appear to be in decline yet some are increasing. Climate change, overfishing, poaching, habitat changes and different feeding strategies in the face of oceanic changes may all be factors impacting seabirds. More data and research are needed to understand what is happening in our oceans and how it is influencing marine life, including breeding seabirds. ICS runs centres at three of the 20 Important Bird Areas (IBAs) of Seychelles: Aride, Silhouette and Farquhar. It has conducted surveys throughout the outer islands of Seychelles including at uninhabited islands. ICS has also identified three new sites that satisfy threshold criteria for inclusion as future IBAs, based on seabird populations: St François Atoll, Bancs Providence and St Joseph Atoll. However, the status of seabird populations at two existing IBA sites is of concern and they may possibly no longer meet IBA thresholds: African Banks and Étoile.



Figure 1. The Seychelles Archipelago. © Mathew Morgan, Island Conservation Society

## **The formation of Island Conservation Society**

Seychelles ranks 54th out of 54 countries of Africa in terms of landmass with less than half the land area of São Tomé and Príncipe ranked just one place higher in 53rd place (List of African countries by area, 2021). However, it has the second largest exclusive economic zone of Africa, just slightly smaller than that of South Africa (Exclusive Economic Zone, 2021). To give a sense of scale, the nation's total landmass is smaller than the Isle of Man, but the islands are spread over an EEZ greater than the landmass of United Kingdom, France and Germany combined. About 90% of the population live on Mahé and most of the rest inhabit the neighbouring islands situated on the shallow Seychelles Bank. This group of 40 granitic islands and two sand cays is known as the inner islands, where breeding seabirds are mainly on a few rat-free islands. On much of the remainder, the outer islands of Seychelles, seabirds are the dominant lifeform, using the scattered coral islands and atolls as a navy might use an aircraft carrier: small but vital bases from which to patrol a vast maritime area.

Until the turn of the millennium, conservation efforts in Seychelles were focused almost entirely on the inner islands, with the exception of the World Heritage Site of Aldabra in the extreme southwestern corner of the archipelago. These outer islands were little known to most Seychellois and rarely visited except for calls by a few charter vessels and by poachers who took turtles, birds and eggs without any control (Edmond 2021). The Wild Animals and Birds Protection Act (14 April 1961) declares eight islands as nature reserves, but without any resident guardians except at one, and there have been no prosecutions.

By the mid-1990s, I had personally sailed to or joined charter boats to visit every corner of Seychelles including all these beautiful and distant islands, but standing on remote shorelines of uninhabited islands brought mixed emotions. There was a sense of privilege but also of dread, because it was obvious that damage was being done and that these small islands were very fragile. I joined with a small group of like-minded people to try to stimulate action. However, government officials had little interest. The islands were too remote, I was told; the logistics of operating there were too difficult and expensive; we have our hands full in the granitic islands. No NGO showed much interest either, for similar reasons.

It was clear that a new NGO was needed to focus on the outer islands of Seychelles. Nearly all the outer islands of Seychelles are government-owned, managed by Islands Development Company (IDC), a government parastatal. Since its creation in 1980, IDC had focused on agricultural development, especially copra production, but it was struggling to make activities pay due to economies of scale compared to Asian countries and high labour costs. If conservation in the outer islands was to take off, IDC had to be on board. I visited CEO Glennly Savy to discuss a plan for a new NGO.

“Adrian, this is music to my ears,” said Glennly. “Copra has gone and that is not such a bad thing because we have raised wages beyond what is competitive in the industry. The future belongs to economic activities with higher value for Seychellois and that means ecotourism and a focus on the protection of the environment”.

Others in Seychelles shared this ambition. They included Dr Rolph Payet, who had obtained his PhD from research in sustainable tourism, and the ornithologist Gérard Rocamora. Together we founded Island Conservation Society (ICS). Other trustees joined, including Dr Jeanne A Mortimer who had spent many years living in the outer islands researching turtle populations, and Pat Matyot, who had a high level of

expertise in the study of local invertebrates and flora. We had no staff, no office and no money, but you have to start somewhere. Today, ICS has a network of five island conservation centres throughout Seychelles with plans for more to be opened. It has an agreement with IDC endorsed by Ministry of Environment to act as conservation advisers in the outer islands and an associated UK Registered Charity, Island Conservation Society UK, which owns the freehold to Aride Island, the largest nature reserve in the granitic islands. Foundations have been formed for twelve islands or island groups to partner with IDC, Ministry of Environment and investors in the islands to raise funds for conservation work conducted by ICS. Endowment funds have been established to support conservation on three islands.



**Plate 19.** Aride Island.

### **Aride Island Nature Reserve**

An early opportunity for ICS came in 2003. Aride Island Nature Reserve is not in the outer islands but retains much the same character, being relatively isolated with no roads, no running water or mains electricity. Aride was purchased in 1973 by the Royal Society for Nature Conservation (RSNC, now the Wildlife Trusts) with funds donated by Christopher Cadbury who was President of RSNC from 1962 to 1988.

Ownership of foreign islands came to be regarded by RSNC as something of an historical anomaly for a wildlife organisation focused on UK conservation. The trustees of RCNC believed the time had come to focus solely upon UK and transfer overseas assets to local management. RSNC had already transferred ownership of Cousin Island in Seychelles to BirdLife International and islands owned in the Falklands to the Falklands Islands Foundation. I met with RSNC on behalf of ICS. A trial management period was agreed with a series of conservation goals to be achieved. ICS met these targets and was able to convince the Trustees of RSNC and the UK Charity Commissioners of their ability to take on the important task of managing Aride Island. A leasehold arrangement was drawn up, the ownership was transferred to Island Conservation Society UK, and the island was leased to ICS Seychelles.

Aride Island Nature Reserve hosts some of the most important seabird colonies of the Indian Ocean. It was recognised as an Important Bird Area (IBA) in 2001, mainly because of its huge seabird populations (Table 1). These include the world's largest colonies of two species: Lesser Noddy and Tropical Shearwater. The Roseate Tern colony of Aride is the largest in Seychelles, and birds are possibly a regional race *arideensis* (sometimes included in race *gracilis*), named after the island.

**Table 1.** Key species of the Aride Island Important Bird Area in 2001.

Globally threatened species - Seychelles Warbler <i>Acrocephalus sechellensis</i>	
Restricted range species - Granitic Seychelles Endemic Bird Area	
Congregatory species	Breeding populations (range)
Roseate Tern <i>Sterna dougallii</i>	1,100–1,300 pairs
Sooty Tern <i>Onychoprion fuscatus</i>	261,000–366,000 pairs
Fairy (White) Tern <i>Gygis alba</i>	3,900–5,900 pairs
Brown Noddy <i>Anous stolidus</i>	4,400–11,600 pairs
Lesser Noddy <i>Anous tenuirostris</i>	136,000–197,000 pairs
Wedge-tailed Shearwater <i>Ardenna pacifica</i>	8,700–28,400 pairs
Tropical Shearwater <i>Puffinus bailloni</i>	43,000–72,000 pairs
White-tailed Tropicbird <i>Phaethon lepturus</i>	276–972 pairs

**Source:** Adapted from Rocamora and Skerrett, 2001.

Seabird research at Aride has included the first study of the use of geolocators to track the movements of pelagic tropical seabirds: Wedge-tailed Shearwater and Tropical Shearwater. This reveals that during late chick-rearing and pre-breeding periods, shearwaters forage relatively close to the colony but outside the breeding season are found on a west-east gradient along the equator, between 5N and 10S. At sea distribution largely matches that of yellowfin and skipjack tunas, emphasising the importance of the association with subsurface predators rather than with physical oceanographic features (Catry *et al.* 2009).

Research also revealed that Tropical Shearwaters dive up to 16 metres whereas Wedge-tailed Shearwaters are more surface feeders, suggesting vertical foraging segregation. Outside the breeding season, the Tropical Shearwater exploits a much smaller marine area than the Wedge-tailed Shearwater, but some travel to the south of Madagascar, the Mozambique Channel, the East African coast, and the Arabian Sea. These results support the hypothesis of a significant interspecific competition between the two species that may apply both at sea for food resources, and on land for habitat selection of nesting burrows (Calabrese 2015).

## Cosmoledo Atoll

The first major project of ICS in the outer islands was launched in 2005, led by founding trustee Gérard Rocamora and funded by Fonds Français pour l'Environnement Mondial (French Global Environment Facility or FFEM). IDC also gave financial and logistical support. The FFEM project included a focus on the restoration of the islands of Cosmoledo, a raised coralline atoll of the Aldabra group and another IBA (Table 2).

Cosmoledo lies over 1,000 km from the inner islands of Seychelles, much closer to Africa (700 km to the west) and to Madagascar (400 km to the southeast) than it is to the main island of Mahé. It comprises thirteen islands and a few tiny islets surrounding a roughly circular lagoon. It is dominated by salt-resistant *Pemphis acidula*, but there are some extensive open grassy areas suitable for three species of ground-nesting seabirds not present on Aldabra (Masked Booby, Brown Booby and Sooty Tern). Populations are globally significant for Masked Booby subspecies *melanops*, Red-footed Booby subspecies *rubripes*, and Sooty Tern subspecies *nubilosa* (Rocamora *et al.* 2003).

The islands of Menai and Grand Ile used to have resident human populations engaged in agriculture, fishing and the exploitation of seabirds, seabird eggs and turtles. However, Cosmoledo was abandoned in the 1980s and it is believed it was

subsequently visited most frequently by boats from both within Seychelles and from Comoros engaged in the illegal poaching of seabirds, eggs and turtles.

**Table 2.** Key species of the Cosmoledo Important Bird Area in 2001.

Congregatory species	Breeding populations (range)
Greater Crested Tern <i>Thalasseus bergii</i>	100–500 pairs
Black-naped Tern <i>Sterna sumatrana</i>	50–100 pairs
Sooty Tern <i>Onychoprion fuscatus</i>	1,100,000 pairs
Red-tailed Tropicbird <i>Phaethon rubricauda</i>	50–200 pairs
Masked Booby <i>Sula dactylatra</i>	5,000–6,000 pairs
Red-footed Booby <i>Sula sula</i>	Over 15,000 pairs
Congregatory species	Non-breeding populations (max.)
Crab Plover <i>Dromas ardeola</i>	2,000
Ruddy Turnstone <i>Arenaria interpres</i>	400

**Source:** Adapted from Rocamora and Skerrett, 2001.

ICS eradicated Black Rats from the islands of Grande Ile (142 ha), Grand Polyte (21 ha), Petit Polyte (1 ha) and set up abatement measures (30 bait stations) to prevent reinvasion at six potential landing points and campsites. There was a significant reduction in the number of cats following rat eradication and invasive Sisal was removed from about 40% of Grand Polyte. Confirmation of success came in 2013 when for the first time since 1964, Masked Booby were recorded breeding at Grand Ile (Skerrett 2013).

ICS has also conducted the first assessment of the Greater Crested Tern breeding population at Cosmoledo with 234 pairs in 2018, and updated the population estimate for the whole of Seychelles to 548–790 pairs (Nogués *et al.* 2018).



**Plate 20.** Cosmoledo Atoll rat eradication.



Plate 21. St François Atoll.

### Alphonse and St François Atolls

The first ICS conservation centre in the outer islands was opened at Alphonse in 2007, to carry out research and monitoring activities here and at neighbouring St François Atoll. A new organisation, the Alphonse Foundation was formed embracing ICS, IDC, Ministry of Environment and hotel investors on the island. Funding was provided mainly from a conservation levy on visitors. An agreement was signed whereby Alphonse Foundation approves projects and budgets for conservation efforts which are then implemented by ICS.

St François Atoll is not classified as an IBA but it really should be. It was proposed and accepted as a candidate IBA in the first inventory of IBAs presented to a national workshop in 1998 (Rocamora & Skerrett 1999). However, it was removed from the final IBA list following concerns expressed by BirdLife Seychelles (now Nature Seychelles) that there were insufficient data to support inclusion. This may have been true at the time, but today, ICS has removed all doubt about the importance of St François for seabirds and shorebirds.

Black-naped Tern was proved to be breeding at St François in 2008 (Adam *et al.* 2008). Regular counts by ICS confirm that St François consistently exceeds IBA thresholds for breeding populations of Black-naped Tern and non-breeding populations for Crab Plover, Ruddy Turnstone and Saunders's Tern *Sternula saundersi* (Skerrett 1996, Skerrett 2001, Betts 2007). Numbers of Whimbrel *Numenius phaeopus* (600 birds) and Grey Plover *Pluvialis squatarola* (250 birds) are below the IBA thresholds, but are still the highest recorded in Seychelles, further illustrating the importance of St François (Betts 2007). Therefore, St François Atoll meets IBA criteria for four species of congregatory waterbirds. In addition, the presence on neighbouring Alphonse Atoll of full-time conservation staff and Blue Safari, a South African eco-friendly tourism operator, makes St François relatively straightforward to protect and thus even more relevant as an IBA.

## Desroches

In 2008, ICS opened its second conservation centre in the outer islands at Desroches, supported by funding from Desroches Foundation, based on the same model as Alphonse Foundation. At this time, Desroches had no remaining breeding seabirds. Almost two centuries of human settlement had resulted in loss of habitat, direct exploitation and the introduction of rats and cats. However, a small colony of Wedge-tailed Shearwaters was discovered in 2001 near the lighthouse, at the northeastern end of the island. This lighthouse colony had disappeared by the time ICS opened up a conservation centre on Desroches, but in November 2008, a small colony, estimated at 20 active burrows, was discovered at the opposite end of Desroches Island, near to the only hotel on the island. Rat controls were implemented, and the colony grew. It was also found to be greater in extent than first realised and by late 2015, 540 active burrows were identified, with a further 15–20 pairs (active burrows) round the lighthouse area. In that same year a pair of Tropical Shearwaters with an egg was discovered nesting within the main colony, the first breeding record of this species from the island.

## Silhouette

In 2011 ICS opened another conservation centre at Silhouette, 20 km north of Mahé. Silhouette is the third largest and second highest island of the inner islands.

There is great diversity of habitat on the island, from coastal reef flats to mist forest. The whole of the 1,995 ha island is an IBA due to the significant breeding population of Seychelles Kestrel *Falco araeus* but there are few breeding seabirds other than small numbers of White-tailed Tropicbird *Phaethon lepturus*.

## Farquhar Atoll

In 2014 ICS opened its most remote conservation centre, at Farquhar Atoll. Farquhar lies 770 km south-southwest of Mahé but only 200 km north-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. The two largest islands of Farquhar, Ile du Nord and Ile du Sud, together with three small intervening islands known as the Manahas, are heavily degraded and the presence of rats further reduces the value for seabirds. However, the remaining uninhabited islands of Farquhar Atoll are included in the Islets of Farquhar IBA. The island with the greatest ornithological interest is Goelettes, the most southerly point of land in Seychelles. In contrast to the other islands, Goelettes is almost treeless; it is covered in grasses, other short vegetation and a few *Scaevola taccada* bushes. ICS confirmed the return of Greater Crested Tern as a breeding species in 2017, at a new sandbank christened Banc Fantala in honour of the cyclone of the same name that created it in 2016 (Duhec *et al.* 2017).

**Table 3.** Key species of the Islets of Farquhar Important Bird Area in 2001.

Congregatory species	Breeding populations (range)
Black-naped Tern <i>Sterna sumatrana</i>	10–30 pairs
Sooty Tern <i>Onychoprion fuscatus</i>	200,000–400,000 pairs

**Source:** Adapted from Rocamora and Skerrett, 2001.

## Other islands

ICS has also conducted seabird surveys at all of the uninhabited outer islands of Seychelles. These include not only the government-owned islands, but also privately-owned St Joseph Atoll. Like St François Atoll, St Joseph Atoll was approved as a nomination for IBA recognition at a national workshop in 1998 (Rocamora and

Skerrett 1999) but later removed by BirdLife Seychelles (now Nature Seychelles) due to reservations over the adequacy of data. However, a 2005 survey by ICS confirmed the site meets the threshold criteria for three breeding species, Roseate Tern, Black-naped Tern and Wedge-tailed Shearwater. It also amply qualifies as a site for congregatory species (Skerrett & Skerrett 2005).

In 2013 and 2016, ICS undertook cruises with the generous assistance of the owner of MV *Pangaea*. Islands surveyed included Boudeuse on the western rim of the Amirantes, protected as a nature reserve and recognised as an IBA but almost certainly regularly poached in the absence of conservation staff. The 2013 *Pangaea* survey reported about 3,000 adult and 350 sub-adult Masked Booby and at least eight nesting sites of Brown Booby plus 13 individuals roosting (Rocamora 2013). This was the first report for about 50 years of Brown Booby breeding anywhere in Seychelles other than Cosmoledo. The 2016 expedition confirmed the breeding presence of Brown Booby and similar numbers of Masked Booby (Skerrett 2016a).

The 2013 expedition also visited African Banks and Étoile, both IBAs and both theoretically protected. African Banks held 40,300 pairs of Sooty Tern in 1955 (Ridley and Percy 1958), 20,300 pairs in 1974 (Feare 1979) and 5,000–10,000 pairs in 2001 (Rocamora and Skerrett 2001). The 2013 visit was outside the tern breeding season and no evidence was found, but it is possible this colony is already close to extinction or may even have been eradicated by uncontrolled poaching (G. Savy pers. comm.) If so, it no longer satisfies IBA criteria.

**Plate 22 a.** Masked Booby. **b.** Brown Booby. **c.** Red-footed Booby.





Étoile was declared an IBA based on a breeding population of 100–200 pairs of Roseate Tern; Sooty Tern also breeds but the population of about 5,000 pairs is below IBA criteria (Skerrett 1995). Due to the timing of the 2013 visit, the status of Roseate Tern remains unknown but the presence of one juvenile and one adult Sooty Tern very late in the season indicate that at least some still breed.

The 2016 *Pangaea* expedition visited Bancs Providence and recorded the first population estimates of breeding Greater Crested Tern and Black-naped Tern, both exceeding thresholds for consideration as an IBA (Skerrett 2016b). The non-breeding population of Crab Plover is close to and may regularly exceed the IBA threshold.

### **Why are some seabird populations declining but others increasing?**

Monitoring of seabirds since the IBA Inventory was produced includes an annual census at Aride. Elsewhere, monitoring is relatively new and it is too early to draw conclusions. At Farquhar, a census was not possible in 2020 because COVID-19 restrictions meant an absence of conservation staff. Cosmoledo has not had a census since 2002. Even at Aride where populations have been monitored for several decades, firm conclusions are difficult to make. However, it is clear several populations have declined significantly despite protection. These include Sooty Tern, Roseate Tern and White-tailed Tropicbird. This rings alarm bells and the most recent management plan for Aride identifies the decline in seabirds as the major conservation concern, seabird populations being Aride's most significant biodiversity attribute (Betts 2020).

**Plate 23 a.** Roseate Terns. **b.** Copulating Black-naped Terns. **c.** Sooty Terns.





Plate 24. Crab Plovers.

Seabird declines of some species may be related to overfishing of predatory fish, notably tuna. Sooty Terns rely heavily on associations with predators such as tuna to catch baitfish prey chased to near the surface and the rapid expansion of industrialised tuna fisheries coincides with the period of decline. About 400,000 tons of tuna are caught by purse seiners annually in the southwest Indian Ocean, including about 80,000 tons in the Seychelles EEZ. EU-controlled fishing vessels have dominated the catch of Yellowfin Tuna *Thunnus albacares* for over 30 years. Today, the stock may be teetering on the verge of collapse; a plan to stop overfishing and restore it has failed. Seychelles benefits from fishing access fees, but other interests pocket most of the profits. EU ship owners pay up to €85 per ton of tuna. At the other extreme a ton of canned yellowfin retails for the equivalent of about €14,000, which means other parties are pocketing more than 99% of revenue generated for this product (Vyawahare 2021).

Jen Telesca, assistant professor of environmental justice at the Pratt Institute in Brooklyn, New York has documented how the Atlantic Bluefin Tuna became an endangered species, and how the International Commission for the Conservation of Atlantic Tunas, an intergovernmental organization responsible for the management and conservation of tuna in the region, presided over what he calls “the managed extinction” of Atlantic Bluefin Tuna (Telesca 2020). History could be repeating itself in the Indian Ocean; EU fishing vessels moved there after the collapse of Atlantic tuna stocks.

Research at Ascension Island indicates a long term significant dietary shift of Sooty Terns during the second half of the twentieth century coinciding with an apparent population collapse of about 84%. Birds have grown more reliant on nutrient-poor squid and invertebrates as fish have declined in availability. As explained earlier, Sooty Terns rely heavily on associations with predators such as tuna to catch fish prey, and the rapid expansion of industrialised tuna fisheries over the same period seems a plausible mechanism. Climate change may also be implicated. This suggests that changes to marine ecosystems have had a dramatic impact on the ecology of the most abundant seabird of the tropical oceans and highlight the potentially pervasive consequences of large predatory fish depletion on marine ecosystems (Reynolds *et al.* 2019).

In 2019, ICS estimated the Sooty Tern population at Farquhar at 205,000 pairs, the lowest figure from surveys over a 5-year period, suggesting a decrease of about 80–90,000 pairs. The most credible reasons for such substantial declines are large-scale environmental pressures, such as seasonal food shortages, either natural or more likely linked to climate change and/or overfishing (Morgan *et al.* 2021).

Elsewhere the situation is complicated by natural factors. Sooty Terns have declined at Aride partly due to habitat loss. At one time, native vegetation was cleared to increase the area of open land for breeding birds and thereby increase the egg harvest. The price of allowing the natural vegetation to regenerate has been a reduction in breeding area. Poaching may also play a part and Sooty Tern eggs are frequently taken for local consumption. However, even this would not explain the apparent decline of other species that have not lost breeding habitat nor are regularly taken by poachers.

Legal collection of eggs is practiced in Seychelles. The Birds Eggs Act 1991 aimed to protect seabird eggs at all but three islands and to control collection of eggs of Sooty Tern and Brown Noddy. Annual quotas were set for collection of eggs of these two species at 30,000 for Bird Island, 70,000 for L'Îlot Frégate and an unlimited quota for Desnoeuvs. However, the Bird Island quota was not respected and the quota for L'Îlot Frégate was probably always in excess of the number of breeding pairs. IDC demarcated part of Desnoeuvs as a no-take zone, but collection was problematic due to the absence of an airstrip and dangerous seas, which resulted in several serious accidents. In 2020, the Birds' Eggs (Collection) Regulations amended quotas, repealing collection on L'Îlot Frégate, but adding a new quota for Cosmoledo of 800,000 and increasing the Bird Island legal quota from 30,000 to 600,000.

As far back as 1976, a major study recommended that in order for the egg harvest to be sustainable, it should be restricted to about 20% of the Seychelles Sooty Tern breeding population of the outer islands (Feare *et al.* 1996). The new legal quota for Cosmoledo represents about 40% of the number of breeding pairs in the outer islands and the Bird Island quota represents about 75% of the number of breeding pairs in the inner islands (based on Feare *et al.* 2007). Birds may lay more than once when an egg is lost, but quotas appear too high, even in a stable system.

Opinions differed as to the wisdom of the commencement of legal collection at Cosmoledo, an IBA and the largest Sooty Tern colony in Seychelles. In an online article, one local collector was quoted as saying, "They should have done this a long time ago as the island has many, many more birds than on Desnoeuvs. It is a good decision because every year when the season opens it seems the demand always surpasses the supply." Comments from readers were less enthusiastic, such as "How long before alarm bells start ringing in this situation. These outdated historic traditions must stop in the modern age" (BirdGuides 2020). One thing both sides can agree on: demand exceeds supply.

The western Indian Ocean still supports over 6,200,000 pairs of Sooty Terns, by far the most common seabird of the region. During the past 200 years, the main drivers of population trends have been habitat change and unregulated human exploitation, so it has been argued even by scientists that regulated exploitation is sustainable (Feare *et al.* 2007). However, if external factors including overfishing and climate change are reducing food supply, sustainability may be impossible with or without an egg harvest. Collection up to the limit of legal quotas will only hasten population declines. The problem is that we do not know whether or not the system is stable; the indications are that it is not.

In 2020 IDC could only collect fewer than 450,000 eggs at Cosmoledo over a period of nearly two months, little more than half the legal quota. IDC said it was "...one of the worst seasons in the collection of birds' eggs this year even though the birds were in abundance" (Joubert 2021). IDC presumed that a lack of food among other factors may

have had an impact on the birds' reproduction cycle. It was decided to stop collection for one year in 2021 in order to assess the national population and take stock of what is happening. ICS, IDC and Ministry of Environment are collaborating in the first national census of all Sooty Tern colonies in Seychelles while collection is suspended.

In contrast to declines in tern populations, some booby populations have increased since the IBA inventory was published. Historically, all booby species in the western Indian Ocean had lost 50% or more of their colonies during almost two centuries of exploitation, and those colonies that survived were significantly reduced in size (Feare 1978). However, with the cessation of exploitation, numbers have increased at some islands.

The Islets of Farquhar IBA inventory recorded a population of Red-footed Booby estimated at 50–70 pairs at the date of its declaration (Rocamora and Skerrett 2001). Today, there are over 9,000 pairs (Le Corre *et al.* 2021). Meanwhile, breeding has been recorded at Marie-Louise since 1997 (R Nolin, in a Ministry of Environment report now lost) and today at least 300 pairs breed. A single pair has bred at St François since 2019 indicating that this island may be next to be colonised (Curd 2021). The cessation of exploitation is undoubtedly a factor to explain increases, but the contrast with population trends for other species on protected islands is stark and may be partly explained by different feeding strategies. Boobies are not surface feeders, but plunge dive several metres, taking mainly flying fish and a small proportion of squid.

Wedge-tailed Shearwaters have also colonised new locations, despite feeding at or near the surface. These include Desroches, North Island and Denis. However, this spread appears to be mainly or entirely down to predator control rather than an increase in total population. Rats have been eradicated at North Island and Denis (under the ICS FFEM programme), while control measures have been implemented at Alphonse and Desroches. However, at protected Aride Island, where there never were any rats, numbers have declined. It is possible that the total population of breeding Wedge-tailed Shearwaters in Seychelles has declined but the number of breeding sites has increased; more work is needed before we know.



**Plate 25.** Wedge-tailed Shearwater.

Marine pollution and climate change are also undoubtedly having wide-ranging effects on marine ecosystems and seabird populations. Fewer than 5% of seabirds studied in 1960 were found to have plastic in their stomachs. By 1980, this number had rocketed to 80% and is forecast to rise to 99% by 2050. ICS monitors plastic pollution but so far has no idea of the scale of impact on seabird populations in Seychelles. Then of course there is climate change. This is a huge subject beyond the scope of this paper, but warming sea temperatures may be dramatically reducing food supply for seabirds in Seychelles.

Twenty years of seabird monitoring in Seychelles is just a small beginning, a drop in the proverbial ocean. We are witnessing, but do not yet understand, the causes of deep perturbations in the system. ICS monitoring and conservation seabird work are indicating trends in populations which are sometimes dramatic. Previously unknown or poorly known populations of seabirds have been discovered. We know that protection and eradication of predators works, but on their own these measures are not enough. Threats to seabirds, especially with regard to food supply, are alarming and are almost certainly due to wider problems that require international support if we are to find solutions. This is beyond a small NGO such as ICS, but ICS can at least ring the alarm bells.

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