

## THE DISTRIBUTION AND BREEDING SUCCESS OF SEABIRDS ON AND AROUND ASCENSION IN THE TROPICAL ATLANTIC OCEAN

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Bourne W.R.P. & Simmons K.E.L. 2001. The distribution and breeding success of seabirds on and around Ascension in the tropical Atlantic Ocean. *Atlantic Seabirds* 3(4): 187-202. *Ascension was once one of the greatest seabird colonies in the world, comparable to the largest in the Pacific and Indian Oceans, the only one in the apparently barren centre of the tropical South Atlantic. The birds have been reduced by introduced rats and cats over the last three centuries, but early accounts, guano and bones suggest there were once more, most breeding in the north of the island. Observations from the shore and at sea indicate that while some seabirds may feed offshore and in an area of marine turbulence in the lee of the island to the west, many fly north towards the Equatorial Counter-current, where there are many more birds and cetaceans than to the south. Periodically there is increased rainfall which may be accompanied by seabird breeding failures, as in 1876, 1924, 1958-59, 1963, 1991-92 and 1997, possibly associated with fluctuations in the counter-current, similar to, but not always simultaneous with, El Niño-Southern Oscillation (ENSO) events elsewhere. There is a need for world-wide monitoring and attention to the implications of these fluctuations.*

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*"We steered away SSE and SSE half East until in the Lat. of 7 deg. 50. min. we met with many Rippings in the Sea like a Tide or strong Current, which setting against the wind caused such a rippling. We continued to meet these Currents from that Lat. until we came into the Lat. of 3 deg. 22 N. when they ceased. During this time we saw some Boneta's and Sharks, catching one of these."*

*William Dampier (1703)*

### INTRODUCTION

Ascension is a recent volcanic island some 10 km in diameter lying at 07°57'S 14°22'W, nearly 500 nautical miles south of the Equator in the central tropical Atlantic (Figs. 1, 2). Its climate is usually dry, with local orographic condensation where the prevailing SE trade-winds strike 500 m Green Mountain in the east, and with torrential rain mainly in March and April at irregular intervals of several years. It originally had a poor flora and terrestrial fauna, now reinforced by introductions, but when first discovered in 1501 many breeding seabirds

Table 1. Seabirds breeding on Ascension. Population size given in individuals (Moreau 1962-63 and Ashmole *et al.* 1994, corrected from later observations).

Tabel 1. Broedvogels van Ascension (individueen; Moreau 1962-63, Ashmole *et al.* 1994, gecorrigeerd voor latere waarnemingen).

Species	Subfossil bones	Recently
Audubon's Shearwater <i>Puffinus lherminieri</i>	*	(1?)
Madeira Storm-petrel <i>Oceanodroma castro</i>	*	3000
Red-billed Tropicbird <i>Phaethon aethereus</i>	*	1100
Yellow-billed Tropicbird <i>Phaethon lepturus</i>	*	2200
Masked Booby <i>Sula dactylatra</i>	**	9000
Brown Booby <i>Sula leucogaster</i>	**	2000
Red-footed Booby <i>Sula sula</i>	**	30
Ascension Frigatebird <i>Fregata aquila</i>	**	<10 000?
Sooty Tern <i>Sterna fuscata</i>	**	350 000
Brown Noddy <i>Anous stolidus</i>	*	1000
Black Noddy <i>Anous minutus</i>		20 000
White Tern <i>Gygis alba</i>	*	5300

\*- some bones, \*\*- many bones found.

occurred (Stonehouse 1962; Packer 1968; Ashmole *et al.* 1994; Ashmole & Ashmole 2000).

By the time of the British Ornithologists' Union's Centenary Expedition to Ascension in 1957-1959 (Stonehouse 1960; Moreau 1962-63), seabirds were mostly confined to outlying stacks except for a vast colony of Sooty Terns *Sterna fuscata* breeding in the south every ten lunar months. Guano and subfossil bird bones are still widely distributed on the low ground, especially in the north, however. This showed that the original species were probably much the same as today (Table 1), with more Red-footed Boobies *Sula sula* and Audubon's Shearwaters *Puffinus lherminieri*, and an extinct endemic night-heron and rail, which may have exploited the seabird colonies (Ashmole 1963a; Olson 1977; Bourne *et al.* in prep).

During 1962-1997 Simmons made a series of visits to the island, latterly with R.J. Prytherch, largely to study the boobies, but also collecting various other information and bones (Simmons 1967a,b, 1970, 1990; Simmons & Prytherch 1994, 1997, 1998). Between 1982-1990 Bourne, W.F. Curtis and other members of the Royal Naval Bird-watching Society (RNBWS) made many voyages from Britain past Ascension to the Falklands, recording the birds seen at sea, and sometimes landing. Since 1987 there have also been visits by the Royal Air Force Ornithological Society (RAFOS) in February 1987 and November 1988 (Blair 1989; Osborn 1994), and Army Ornithological Society

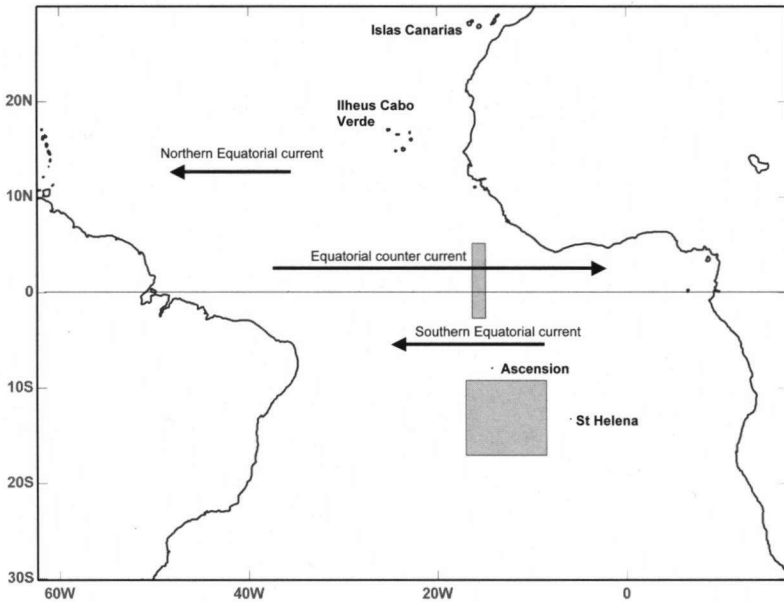


Figure 1. Location of Ascension and (shaded) areas of observation in Table 2.

Figuur 1. Ligging van Ascension en (gearceerd) de locaties waar de in tabel 2 weergegeven waarnemingen werden verricht.

(AOS) with members of the other societies in March 1990, June-July 1992, and April 1994 (Nash *et al.* 1991; 1992, Hughes *et al.* 1994; Dickey *et al.* 1997). These results are summarised by Bourne & Simmons (1998, Table 1), and we now draw some general conclusions about the seabirds on Ascension.

### THE DISTRIBUTION OF SEABIRDS ASHORE

It remains debatable how many seabirds formerly bred on Ascension, which lies far from the continental shelves in an area of impoverished tropical surface water where birds are normally only seen at intervals of hours or days (Table 2 part 2). Large quantities of bird remains and guano are still found in areas where the birds must have gone over a century ago, however, with more in the north of the island (Fig. 2). Since such remains are very durable in such a dry climate it is possible that they were deposited over a long period. Populations no larger than the present ones may have moved around, perhaps to avoid the accumulation of parasites, as with Sooty Terns on Bird Island in the Seychelles

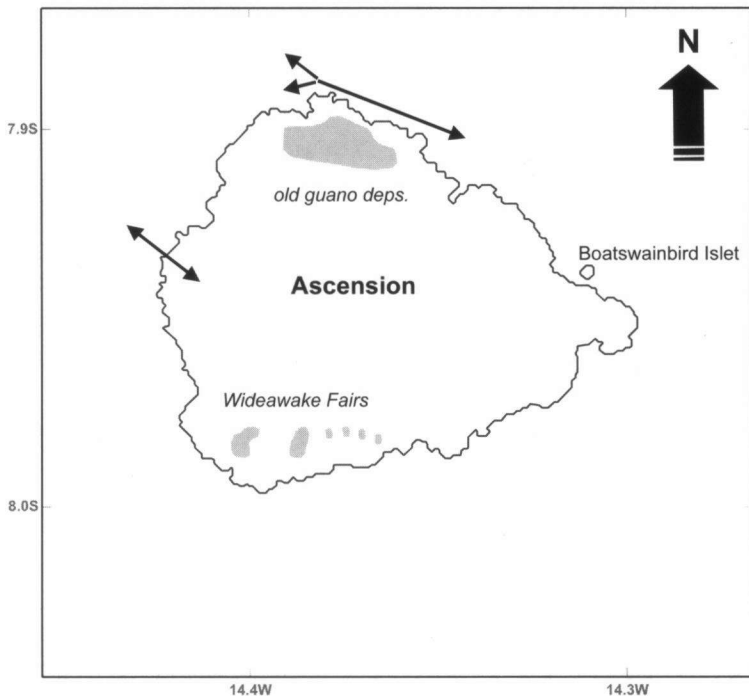


Figure 2. Ascension Island, location of greatest old guano deposits and modern Wideawake Fairs, and most important directions of movement of the birds.

Figuur 2. Ascension, locatie van oude vogelmestafzettingen en moderne Wideawake Fairs en de belangrijkste vliegrichtingen van broedvogels.

(Feare 1976), since a similar tick *Ornithodoros denmarki* was also found in the Ascension Wideawake Fairs (colonies) in 1990.

The possibility that seabirds were once more numerous is confirmed by a report by Van Linschoten in 1589. When they called at Ascension "birds of the bignesse of young geese... came by thousands flying about our ships, crying and making great noyse, and ran up and down in the ship, some leaping and sitting on our shoulders and armes, not once fearing us, so that we took many of them and rung their neckes, but they are not good to eate, because they taste morish (fishy)" (Tiede 1885), in a way now unknown anywhere. The large seabird seen most often by the RNBWS on ships in the tropics is the Red-footed Booby, which normally nests on trees and is now rare at Ascension. Its fossil remains are common there, however, and the lava-flows are stained with old guano in patterns suggesting it nested on them instead.

Table 2. Birds and cetaceans seen in ten-minute periods during ten voyages by Bourne, two by W.F. Curtis, two by B.W. Rowlands, and one by Cadée (1981), 1979-1990.

Tabel 2. Vogels en walvisachtigen in tien-minuten perioden tijdens 10 reizen van Bourne, twee van W.F. Curtis, twee van B.W. Rowlands en één door Cadée (1981), 1979-1990.

Birds and cetaceans seen per hour within 5° of the Equator between 15-17°W

Month Hours	Aug 2.8	Oct 12.7	Nov 4.7	Jan 4.7	Feb 22.7	Apr 5.8	May 12.8	Total 66.2
Bulwer's Petrel								
<i>Bulweria bulwerii</i>						0.2	0.4	6
Cory's Shearwater								
<i>Calonectris diomedea</i>			8.1	3.1	7.2	3.4		229
Great Shearwater								
<i>Puffinus gravis</i>							2.7	26
Large shearwaters								
<i>Calonectris/ Puffinus</i>		0.2					1.0	12
Wilson's Storm-petrel								
<i>Oceanites oceanicus</i>			0.2					1
Leach's Storm-petrel								
<i>Oceanodr. leucorhoa</i>			3.6	5.1	12.0	0.2		313
Madeiran Storm-petrel								
<i>Oceanodroma castro?</i>	0.7		0.6	3.2	0.3	1.0	1.3	50
Storm-petrel								
<i>Hydrobatidae</i> sp		3.6		1.3	0.2	0.2		58
Masked Booby								
<i>Sula dactylatra</i>					0.04		0.5	8
Large skua								
<i>Catharacta</i> sp				0.4				2
Small skua								
<i>Stercorarius</i> sp			3.4		0.7	1.9		43
Sooty Tern								
<i>Sterna fuscata</i>	0.4			5.1	10.0	42.9	0.1	495
Arctic Tern								
<i>Sterna paradisaea</i>						3.6		21
Terns <i>Sterna</i> sp		6.1				10.2		138
Noddies <i>Anous</i> sp					0.4	8.6		54
Large whale sp				1.7	0.4			16
Pilot whale sp				6.4	0.04			31
Dolphin sp					>0.4	8.6		>60
Total	1.1	9.9	16.1	22.7	31.6	80.8	10.7	1563

[Table 2 continued]

## Birds and cetaceans seen per hour between 10-20°S and 8-21°W

Month Hours	Aug 3	Sep 5	Nov 4	Jan 5	Feb 11	Apr 2.8	May 11.5	Total 42.3
Bulwer's Petrel								
<i>Bulweria bulwerii</i>			0.25		0.09			2
Great Shearwater								
<i>Puffinus gravis</i>							0.09	1
Madeiran Storm-petrel								
<i>Oceanodroma castro?</i>					0.09			1
Black-bellied Storm-petrel								
<i>Fregetta tropica</i>							0.09	1
Yellow-billed Tropicbird								
<i>Phaethon lepturus</i>			0.25					1
Large whale sp		0.40						2
Total	0	0.40	0.50	0	0.18	0	0.17	8

Some identifications may be uncertain; thus Wilson's and Madeiran Storm-petrels may have been identified as Leach's, which certainly come on board ships much more often (Bourne 1992). It is also uncertain if the few large skuas *catharacta* sp. were *C. skua*, *C. antarctica* and its allies, or *C. maccormicki*, but all three smaller skuas *Stercorarius* sp. have been reported, *S. parasiticus* in November and February, *S. pomarinus* in February, and *S. longicaudus* in April. Arctic and possibly other terns also appear to stage in this area on migration. The cetaceans included Sperm Whales *Physeter catodon* in January, a Sei Whale *Balaenoptera borealis* and other unidentified rorquals in February, a Bryde's Whale *B. edeni* in October, and unidentified smaller species, none seen around Ascension.

## THE DISTRIBUTION OF THE BIRDS AT SEA

The long incubation shifts found for several Ascension seabirds (Moreau 1962-63) imply that they travel far to feed. Stonehouse (1962) suggested they may exploit enriched water to lee of the south-west African upwelling. This might be reinforced by the passage of mesoscale eddies of upwelling water raising nutrients and food from the thermocline along the northern border of the Benguela Current where it passes west out to sea around 20°S to become the South Equatorial Current (Diester-Haass 1985), in the way found along the Gulf Stream (Haney 1986). However, Rowlands (1992) and Barritt (1992) among others have failed to find many birds here.

Oceanographic investigations, the presence of more bones and guano in the north, and the main direction of flight of the birds (Fig. 2) and their density at sea (Table 2) indicate that most birds may feed instead to the north of Ascension. Bourne (1955) has postulated that the Atlantic equatorial current

system (Fig. 1), apparently first described by Dampier (1703, quoted above) may provide food for seabirds here. Basically the easterly trade-winds drift surface water to the west in the tropical oceans, and compensatory counter-currents then return east, often below the westward surface drift. The change in the direction of Coriolis' force also leads to a divergence in westbound currents near the equator, causing local turbulence and upwelling. This leads to increased biological productivity, attractive to tuna which drive their prey to the sea surface where it becomes available to birds (Khanaychenko 1965; Neumann 1965; Longhurst & Pauly 1987; Scullion 1990 in Ashmole *et al.* 1994).

The RNBWS have reported flocks of seabirds occur here (annual reports in *Sea Swallow*), but there have been few detailed accounts, possibly because most activity occurs over a narrow, fluctuating belt which is liable to be crossed in a few minutes, half the time by night, when the birds can only be heard calling in the darkness. Where counts were made, the vicinity of the equator was frequented by over a hundred times more birds than a comparable area to the south (Table 2), and Jespersen (1930) reported equally few birds to the north.

In general, Ascension seabirds go out to sea in the morning, and few can be seen feeding from the shore except when there is an influx of pelagic prey fish. Flocks of hundreds of Ascension Frigatebirds *Fregata aquila*, Masked and Brown Boobies *Sula dactylatra* and *S. leucogaster*, Sooty Terns, noddies *Anous* sp. and White Terns *Gygis alba* feed in declining numbers for at least a hundred miles out to sea during the day. When a flock formed the first birds to appear were adult Ascension Frigates which came down out of the sky, after which Sooty Terns, Black Noddies *Anous minutus* and Masked Boobies, with a few Brown Boobies and small skuas *Stercorarius* sp. joined them over the sea. Although the skuas often chased the other birds, the Ascension Frigates did not hover over the rest and parasitise them as Magnificent Frigatebirds *Fregata magnificens* do around the West Indies, but led the feeding frenzy, though they rob other birds at other times.

These fish shoals might be feeding in eddies passing along the South Equatorial Current as already mentioned. Alternatively, when naval exercises were carried out west of Ascension on 11 Feb 1985 most birds were seen where the sea surface temperature fell from the usual 27.8° to 26.8°C eight miles offshore, implying turbulence and upwelling to the lee of the island. A thousand Black Noddies with fewer Brown Noddies *Anous stolidus*, Brown Boobies and an immature Red-footed Booby occurred here again on 16 April 1986, when although some breeding Sooty Terns dispersed in all directions, most went NW. In 1976-1977, 1993 and 1996-1997 Simmons and Robin Prytherch also saw many birds, mainly boobies and Black Noddies, return from the NW along the north coast of Ascension in the evening to roost in the vicinity of Boatswainbird

Islet (Simmons 1990; Simmons & Prytherch 1994, 1997), as also reported by Blair (1989) and Hughes *et al.* (1994). The main flight-line of Sooty Terns returning to the south of the island is also from the north-west (Simmons & Prytherch 1997; Bourne pers. obs.), so most seabirds may feed in this direction.

Further out to sea the SE trade-wind usually extends north across the equator in the northern spring and summer, doubtless drifting the birds west, which may explain why more were seen returning from the north-west at dusk than departing in that direction in the morning. While some birds were seen along the equator at this season, the numbers were higher, with feeding flocks of many Sooty Terns and fewer shearwaters, where the equatorial counter-current is marked on the chart far to the west off northern South America. Incidentally, although Sooty Terns are alleged to remain on the wing for months on end (Ashmole 1963b), on 22 May 1985 Bourne saw about thirty briefly fold their wings and sit together on the water in the middle of a feeding flock of about 500 birds at 08°13'N 52°20'W. In the autumn and winter the vicinity of the equator north of Ascension was more often calm ('the doldrums'), and birds were then more noticeable there, with shearwaters and even storm-petrels also often resting on the water in flocks.

Bourne also saw scattered Sooty and other terns, Cory's Shearwaters *Calonectris diomedea*, Leach's *Oceanodroma leucorhoa* and other storm-petrels, skuas, a Masked Booby, several rorquals, and many dolphins, at 04°S 15°W on 10 Feb 1985, when the sea showed the clear lanes separated by lines of ripples aligned north and south caused by internal waves where opposed currents occur at different levels (Longhurst & Pauly 1987). Presumably this patterned water surface marked the narrow eastward flow sometimes submerged below the westward drift of surface water before the trade winds reported within the westerly South Equatorial Current at this latitude by Mazeika (1968). The birds fed over the lines of ripples in the way described by Haney (1987), and settled to rest in the calm lanes in between. Their numbers reached a climax where a long drift-net, presumably set for tuna, was aligned east and west along the southern boundary of the patterned water, and declined to the south. Many birds have also been found further east along the equator where there is a fertile 'dome' in the thermocline at the end of the counter-current in the Gulf of Guinea (Mazeika 1967) during the northern winter by Cadée (1981), and in April by Lambert (1988).

The equatorial counter-current also appears to provide an important winter-quarters for Sooty Terns (Robertson 1969) and storm-petrels. In addition to numerous northern Leach's Storm-petrels *Oceanodroma leucorhoa* (Bourne 1992) the type of the Black-bellied Storm-petrel *Fregetta tropica*, thought to be 'confined to the equatorial regions, being most abundant in the vicinity of the line' (Gould 1844), but now known to breed to the south, was taken here at



06°33'N 18°06'W in July 1838, with "*Rhynchops*" (presumably Sooty Terns?) and frigates (Gould 1840). There is another old *F. t. tropica* from 00°12'S 30°W, a Tristan White-bellied Storm-petrel *F. grallaria leucogaster* from 07°05'S 03°30'W on 11 Apr 1950, and a Tristan White-faced Storm-petrel *Pelagodroma m. marina* from 05°S 4°W on 23 Apr 1957, all in moult, and an Antarctic Tern *Sterna vittata* said to come from between Ascension and St. Helena (Saunders 1876) in the (British) Natural History Museum, and two *F. g. leucogaster* from 03°02'S 03°W on 31 May 1916 at Leiden.

### POTENTIAL ENSO-RELATED EVENTS

St Helena was included among the areas affected by droughts during a major El Niño-Southern Oscillation or ENSO due to global fluctuations in the atmospheric pressure as early as 1791 (Grove 1998). Similar events have been identified again in the Atlantic as well as the Pacific during more recent major ENSOs (symposium in *Nature* 322: 236-253; Longhurst & Pauly 1987; Glantz 1996; Davis 2001). These include a long series of records of fluctuations in the Humboldt Current affecting breeding seabirds at the time of the arrival of El Niño at Christmas along the west coast of South America, and more recently the Benguela Current off SW Africa and the Christmas Island which occupies a comparable position to Ascension on the north side of the equatorial current system in the central Pacific (Duffy & Schreiber 1988; Schreiber & Schreiber 1989). While there are few regular records of tropical seabird breeding performance on oceanic islands elsewhere except recently for Roseate Terns showing a similar pattern in the Seychelles in the Indian Ocean (Ramos 1998), on Ascension there are also records of exceptional rainfall (Duffey 1964; Walmsley 1997), also be related to ENSOs, as follows:

**1876-1877** On 5 September 1876 a local naturalist, Unwin, reported to Howard Saunders that the Sooty Terns had "remained months longer than usual, due to a very unusual downpour of rain, which flooded their breeding ground, and killed thousands of young birds. They left about May, and were back in August" (Penrose 1879). It seems debatable if the mortality was necessarily due to the downpour, which Duffey (1964) reports occurred on 26 March 1876. Gill (1878) reports the terns returned on time two breeding cycles later in October 1877. By this time an ENSO had caused droughts and famines throughout the world (Nicholls & Katz 1991; Davis 2001).

**1924-1925** Three days of heavy rain were also associated with poor breeding success for the Sooty Terns in February and March 1924 (Huckle 1924; Duffey 1964), and subsequently interfered with the collection of guano in 1925-1928

(Packer 1968). There were exceptional Niño conditions in both the Humboldt and Benguela currents in 1925 (Murphy 1936: 103), and a very severe ENSO in SE Asia in 1925-1926 (Davis 2001).

**1957-1959** The BOU Centenary Expedition found that first the chicks of the Masked and Brown Boobies and Black Noddies starved while the Sooty Terns were away in July-October 1958, and then when the Sooty Terns returned their young also starved in January-February 1959, though the other seabirds appeared unaffected (Moreau 1962-63; Ashmole *et al.* 1994). There was an ENSO in the Pacific, Brazil and China in 1957-1958 and disturbance of the marine biology of the tropical Atlantic in 1958-1959 (Longhurst & Pauly 1987; Davis 2001).

**1963** There was 295 mm of rain on Ascension in March, when the annual mean between 1962 and 1987 was 176mm (RAF records, Simmons 1967b; Packer 1968). At the two Brown Booby colonies studied in 1962-1964 by Simmons (1967b, 1970), laying ceased from 7 February-15 July 1963, the males lost the breeding colour of their bare parts, the birds made unusually long hunting trips out to sea, nine of eleven dependent juveniles returned to be fed for much longer than usual, and the other two almost certainly died. In late February and March 1963 some Sooty Terns also deserted their eggs, and at least one pair was abandoned. The birds were about a month late in returning to breed (Simmons and John Packer, personal observations). There was an ENSO in the Pacific (Jordan 1991).

**1972-1974** An ENSO in the Pacific, Brazil, Africa and Asia in 1972-1973 was also followed by 104 mm of rain in Ascension in March 1974, but there were no observations on the birds then.

**1982-1984** There was a major world-wide ENSO in 1982-1983 (Davis 2001), with a massive disruption of seabird populations in the Pacific (Schreiber & Schreiber 1984), followed by a prolonged decline in Great Frigatebirds *Fregata minor* in particular during Christmas Bird Counts at Hawaii (Vandenbosch 2000). 152 mm of rain fell on Ascension in March 1984, and 339 mm in April 1985, but there were no observations on the birds. The Sooty Terns may have been away, since when Bourne passed through the island in October 1984 they had eggs and young, though Brown Boobies on the Stacks had no large chicks.

**1986-1988** There was seabird mortality off SW Africa in 1985-1986 (Crawford *et al.* 1986) and a Niño in the Pacific in 1986-1987. The Sooty Terns started breeding on Ascension in December 1986 (Islander 12 December), and two

RAFOS Expeditions found them completing cycles in February and November 1987, but nothing unusual was noticed (Blair 1988; Osborn 1994) except 135 mm of rain on Ascension in April 1988. The Roseate Terns on Aride Island in the Seychelles had poor success in the northern summers of 1985-1988 (Ramos 1998).

**1991-1992** There was a Niño in Peru and severe drought in Africa and Mexico between September 1991 and March 1992 (Davis 2001). The Sooty Terns returned to Ascension in late October 1991 and were incubating by December, but the eastern Mars Bay Fairs were then abandoned, and some 23 600 and 20 700 eggs deserted, though reduced breeding continued at the Waterside Fair and at Pillar Bay to the west. They laid again at the Waterside Fair in September (N.J. Sylverwood Brown, Islander 31 January, 14 February, 16 April and 18 September, and with B.J. Hughes in Nash *et al.* 1992). After two good years the Roseate Terns in the Seychelles failed to breed in 1991 and had poor success in 1992 (Ramos 1998).

**1997** Simmons and Prytherch (1998) visited Ascension in October and November during an ENSO with world-wide repercussions (Davis 2001). They found that the Pelecaniformes and Black Noddies were exploiting a coastal influx of fish, but a Sooty Tern breeding cycle had failed with massive desertion of eggs and small young (including 97 000 in one 'fair'), and there were many non-breeding birds. The Roseate Terns on Aride Island in the Seychelles also had poor breeding success again after four better seasons (Ramos 1998).

Thus as occurs with the variable timing of ENSOs elsewhere (Davis 2001) ornithological effects of oceanic and climatic fluctuations in the tropical Atlantic often appear to occur within months of, but not always simultaneously with, the more prominent events in the Pacific (Longhurst & Pauly 1987), and also Indian Ocean (Ramos 1998). Part of the breeding population of Sooty Terns on Ascension with their short breeding cycle may then be washed out, fail to lay, desert their eggs or lose their chicks, though they maintain their normal 10 lunar month breeding cycle afterwards. The Brown Boobies, on the other hand, which breed continually with a longer cycle, may try to rear existing young with reduced success, but lay no more eggs. It is not yet clear what happens with the other seabirds, but the Masked Boobies and Black Noddies may also be affected, while the tropicbirds and frigates may not (Ashmole *et al.* 1994). These events do not appear so closely related to seabird breeding failures in higher latitudes, as in the North Atlantic in recent years, and to the south in 1977-1978, 1983-1984 and 1985-1986 (Bourne 1987, Croxall *et al.* 1988), which may be affected by local factors.

## CONCLUSION

It appears Ascension once formed the only breeding-station for a large, distinct community of seabirds, including the endemic Ascension Frigatebird and many more Red-footed Boobies than are found now, exploiting a biologically-enriched area along the equatorial counter-current about 500 nautical miles to the north in the tropical Atlantic. Its numbers have been reduced over the last 500 years as a result of human activity, especially the introduction of cats (Ashmole *et al.* 1994).

It appears that while Ascension Sooty Terns breed very regularly every ten lunar months (Chapin 1954), there are also variations in the weather and seabird breeding success in this area comparable with those elsewhere. This may help explain the poor breeding success of some seabirds found by the BOU Expedition on Ascension in 1958-1959 (Ashmole *et al.* 1994). It is however notable that AOS censuses of Sooty Terns breeding on Ascension indicated a population of 176 000 in March 1990 before a breeding failure, 202,000 in November 1996, and 207 000 in June 1998 after a breeding failure the previous year (Hughes 1999). Thus these events do not appear to have affected the adult population of these and other seabirds, who can presumably if necessary disperse until conditions improve.

Such events make it increasingly necessary to exercise care in interpreting such factors as breeding seasons, cycles and success and adult survival of seabird populations, since they may also have other more complex effects, including for example not only a change in the food supply, but in the weather, the vegetation, and the number of predators or competitors at the breeding places, cascading up and down the food-chain afterwards (Holmgren *et al.* 2001). Therefore it seems desirable that attempts to rehabilitate the damaged ecology of oceanic islands should be accompanied by a long-term, but perhaps low intensity, international monitoring programme, as discussed in Symposium 29 at the 19th International Ornithological Congress in 1986 (Schreiber & Duffy 1988) and by Schreiber & Schreiber (1989).

While there are records from western South America for a long period, and they are now made more widely in the eastern Pacific, there are still very few from elsewhere in the tropics. If possible in addition to Ascension they should be obtained from at least the islands in the Gulf of Guinea to the east and Fernando de Noronha and Rocas Reef to the west in the Atlantic, on Christmas Island (Schreiber & Schreiber 1984) and Henderson Island (Brooke 1995) where reduced seabird breeding success has occurred during ENSOs, but in the latter case was attributed to rats, among many other places in the Pacific, and on Christmas Island with another endemic frigatebird, *Fregata andrewsi*, and

endemic Abbott's Booby *Papasula abbotti*, and other island groups in the Indian Ocean, to discover more about the fluctuation in breeding success.

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#### DE VERSPREIDING OP ZEE EN HET BROEDSUCCES VAN DE ZEEVOGELS VAN ASCENSION IN DE TROPISCHE ATLANTISCHE OCEAAN

Omvangrijke afzettingen van vogelmest, grote hoeveelheden subfossiele en fossiele vogelbotten en historische verslagen van zeevarenden laten zien dat vroeger op Ascension belangrijke zeevogelkolonies moeten zijn geweest. Geïntroduceerde ratten en katten hebben daaraan gedurende de afgelopen drie eeuwen effectief een einde gemaakt. De vroegere zeevogelkolonies zijn naar alle waarschijnlijkheid vergelijkbaar geweest met de grootste kolonies in de tropische Grote en Indische Oceanen en het was de enige geschikte broedplaats in dit afgelegen, op het eerste gezicht voedselarme gedeelte van de Atlantische Oceaan. Op grond van waarnemingen ten noorden en ten zuiden van Ascension, aangevuld met gegevens over vliegrichtingen bij vertrek- en aankomst van de zeevogels die hier nu nog steeds broeden, en de ligging (het noorden) van de nu verdwenen en zonder meer meest belangrijke kolonies uit eerdere jaren wordt afgeleid dat veel zeevogels van Ascension op grote afstand van het eiland foerageren. De verzamelde aanwijzingen suggereren dat het vooral de Equatoriale tegenstroom is (een naar het oosten gerichte waterbeweging; Fig. 1) waar de meeste zeevogels en zeezoogdieren gezien worden. Behalve de broedvogels van Ascension foerageren hier ook soorten die elders broeden en hier als doortrekkers of tijdelijke pleisteraars voorkomen. Op Ascension wordt soms exceptioneel veel neerslag gemeten, soms leidend tot het afbreken van het broedseizoen van de grondbroeders (1876, 1924, 1958/59, 1963, 1991/92 en 1997). Deze regenval lijkt samen te hangen met fluctuaties in de kracht van de Equatoriale tegenstroom en is vergelijkbaar met, maar niet altijd simultaan optredend met de El Niño/Southern Oscillation (ENSO) in de Grote Oceaan. De auteurs geconstateren dat er een grote behoefte bestaat aan een wereldwijd monitoringprogramma waarin de effecten van dergelijke fluctuaties in de voornaamste golfstromen worden gedocumenteerd.

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