

EXERCISE BOOBY II

ABWS EXPEDITION TO ASCENSION ISLAND MARCH 1990

By

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STATUS AND CONSERVATION STUDIES

Introduction

Exercise BOOBY II was an ABWS sponsored expedition to Ascension. It was the third in a series of tri-service ornithological expeditions to assess the status of the breeding birds of Ascension Island. The expedition had 10 members, 7 from the Army, one from the Navy and two civilians, one from the ABWS and the other from RAFOS. Whilst on the Islands, the team was joined by Dr Philip Ashmole, Dr Myrtle Ashmole and Dr Ken Simmons, all professional zoologists, two of whom have spent a considerable period of time studying the Ascension birds.

Aims

The aims of the expedition were:

To assess the size of the sea birds breeding populations as far as possible in two weeks.

To assess the size and position of the breeding colonies or "fairs" of the Wideawake or Sooty Tern *Sterna fuscata*.

To assess the effect of feral cat predation on the Wideawake population.

To investigate the possibility of excluding feral cats from some or all of the Main Island to allow re-colonisation.

The expedition members each had their own study species and special responsibilities. John Walmsley, the civilian ABWS Member was in charge of Wideawake Studies and was ably assisted by Maj John Hughes, who mapped the colonies. Other members assisted as required and carried out extensive census work of other species.

This article covers the work of Exercise BOOBY II in four parts:

An introduction and brief history of the birdlife.

A description of the current bird life and site surveys.

A discussion on possible ways to protect birds from the cats.

Studies covering mapping by John Hughes and cat predation by John Walmsley.

History of Ornithology Ascension Island

When the island was discovered in 1501 by Juan da Nova, Ascension was swarming with sea -birds, estimated from the pattern of guano deposits to number some 40 million. The island also had at least two and possibly three endemic species, a variety of small heron (yet to be confirmed), the Ascension Rail *Alantisia elpenor* and the Ascension Frigate Bird *Fregata aquila*. Only the last survives today.

Settlement occurred in 1815 when a party of Royal Marines garrisoned the Island to deny it to any Frenchman with thoughts of using it as base to rescue Napoleon from St Helena. The Marines introduced cats to eat the rats, which had arrived with earlier visitors; these found the birds much easier to catch, and over the next 40 or so years eliminated the sea -bird populations on the main island.

Various introductions were tried in the 19th century. These included Guinea Fowl, Thrushes, Starlings. Rooks, Jackdaws and Barn Owls all of which died out.

Present Status of Breeding Birds

Ascension Island now has 11 species of sea -bird and five land birds, the latter all introduced. A list of these is at Table 1 with brief remarks about their status and breeding requirements.

Sea – birds

With the exception of the Wideawake Tern, the others to breed successfully need a nest site inaccessible to feral cats. Breeding is thus confined to Boatswain Bird Island (BBI) which holds some 90% of the population on offshore stacks and sea cliffs. The stacks can be hazardous as the lower ones are washed over by a freak wave, caused by a storm many miles away. The White Tern also breeds on inland cliffs and is reported to nest in Eucalyptus trees. We believe the populations are now limited by the availability of secure nest sites. This is certainly true of the Masked Booby and the Ascension Frigate Bird which require level ground for nesting and are confined to the top of BBI. Indeed the entire world population of the Ascension Frigate Bird breeds only on BBI, where we made a count of 2,500 individuals. We observed Masked Booby displaying on Letterbox, an area adjacent to BBI, and it is likely this would be re-colonized if cats were removed. As its area is 10 times that of BBI this is an exciting prospect.

Recording Methodology

The BOU Expedition, (Stonehouse 1962), showed that though most of the birds breed throughout the year the numbers doing so at anyone time does vary. In some cases such as the Maderian Storm Petrel and Wideawake the pattern follows a time cycle, whereas in others it is the availability of food, as Simmons (1967) showed with his studies of the Brown Booby. Stonehouse (1962) also found there was a certain amount of "hot -bedding" of suitable nest sites. These factors made the task of assessing the status of breeding birds in a fortnight a daunting one. As the study of the Wideawake was a priority, our visit was timed to coincide with its breeding cycle, which meant we almost completely missed the Maderian Storm Petrel.

The best we could do was to visit all possible nest sites and record the number of birds present; 87 of the 122 one - km grid squares on Ascension Island were visited. Maximum counts could only be made at first light as the birds departed to their feeding grounds offshore very soon after dawn. They did not return until late evening, with a significant number flying in after dark. As the sites could only be reached on foot and the difficult going made night movement impossible, observers had to be in position overnight.

We had hoped to be allowed to stay on BBI in order to conduct a proper survey, but we were refused permission to land by the Administrator in spite of support from the International Council for Bird Preservation. This made counting there difficult; however good counts were made of Masked Boobies and Ascension Frigate birds on the top of the Island from Powers Peak on the mainland. It was impossible to count the cliff nesting species using this method and this was done from a boat during a 2 hour daytime visit - not ideal for either timing or counting. Using binoculars on a pitching boat is the best method of encouraging sea sickness I have yet to discover!

Blair (1989) mapped the fly ways of sea -birds to their feeding location north west of Ascension. This produced a spectacular passage of birds departing and returning daily and it was hoped that counts of these movements would provide some guide to the number present. Daily counts were made but the inconsistency of the results made it clear that no reliable extrapolations could be made. Moreover a large and variable proportion of the birds moved too far out to sea to be identified and counted.

Conclusion

The census of sea -birds is not easy, particularly in the tropics where the birds have a rolling breeding programme. Our two week count was at best a snap shot of the year, and many species may be under-recorded. Schreiber and Schreiber (1986) found from ringing studies that a maximum count may represent only some 20% of the total population.

Status of Land Birds

There are five species of land bird currently breeding on Ascension Island. All have been introduced and their status is given in Table 1. We saw all species, but made no systematic attempt to assess their numbers or breeding distribution as we did not have the time. There appears to have been a general increase compared

with the figures given by Stonehouse (1962), with the possible exception of the Red-necked Francolin. This is probably due to the increase in the amount of vegetation particularly on the lower slopes. We found flocks of c100 Red - cheeked Wax bills feeding on grass seed in Mars Bay, near sea level.

Improving the Environment for Breeding

One of the aims of the expedition was to investigate ways of improving the environment for breeding sea -birds, by eliminating feral cats from some or all of the main Island. There were suggestions of building a cat proof fence to make Letterbox a safe haven, or creating another BBI, by blasting a channel across the base of an isthmus. When viewing a map, such ideas appear attractive; on the ground, the scale of engineering and logistic effort required becomes immediately apparent and rules such ideas out of court. The nature of the ground makes us doubt whether a cat proof fence is realistically possible and we believe it would have to be supported by continuous control measures within the safe area.

The elimination of alien pests on other islands has been achieved and it is feasible to eliminate feral cats on Ascension. A motion recommending the Government take such action was passed at the XXth World Conference of the International Council for Bird Preservation in 1990. At present the matter is with the Foreign and Commonwealth Office, awaiting a decision. There are local fears that rats and mice will become pests if feral cats are removed and as always there is the question of funding the work.

History of the Wideawake Tern on Ascension Island

It is possible that Wideawake bred on much of the main island prior to the introduction of cats in the 1820s. Now the colonies or fairs are confined to Mars Bay in the south west corner of Ascension and to the lava flows at the eastern end of the runway about 2 kilometres to the east. They alone have survived the ravages of the cats because of their breeding habits. They nest every 10 lunar months; 6 of these are spent at the nest sites and 4 far out to sea. These 4 months are lean times for cats and starvation has kept their numbers at a level which the terns can tolerate.

An old photograph left us with a puzzle over the preferred nesting site. Wideawake Terns now tend to nest in areas of lava flow or amongst rocks and stones. Ashmole on the BOU Expedition in 1958 found that the birds avoided open areas of smooth sand or grit and we noticed the same in 1990. There is however a pre -World War 2 photograph in the Ascension Island Museum showing a dense colony of Wideawakes nesting on a smooth and sandy plain in an area which is now the runway. Has the building of a runway forced the birds into the lava flows, or were those in the sand area overflowing from a preferred rougher site?

MAPPING THE SOOTY TERNS - Maj B.J.Hughes

The status of Wideawakes or Sooty Terns, *Sterna fuscata* on Ascension Island has never been accurately determined. In the eighteenth and nineteenth centuries vast numbers nested on the island and in this century estimates of their numbers have ranged from 750,000 in 1957 -59 (Ashmole, 1963) to 100,000 in 1987 (RAFOS).

Without an accurate count it is impossible to determine trends in their numbers. One of the main aims of the ABWS expedition was to determine a baseline which would enable a rigorous comparison of their numbers to made in future years.

Sooty Terns spend most of their life on the wing, many miles out to sea, and only return to Ascension to breed. They are gregarious birds and because of their habits and numbers are extremely difficult to count.

Nettleship (1976) describes census technique for terns which involves mapping their colonies and taking sample density counts and this was the method adopted by the expedition.

This paper is concerned entirely with the mapping aspects of the census. Each colony on the island was surveyed, its area determined and its outline accurately drawn on a map. Sample density counts were conducted under the guidance of Dr N.P.Ashmole and were used to determine the estimated number of eggs in each fair (Table 2).

Sooty Terns are present on Ascension Island for six months at a time. They get together in large densely packed groups or "fairs" every ten lunar months to lay their single egg and to rear their young. They nest on flat ground in small scrapes in the lava dust or on the lava rock. The fairs are now exclusively in the south-west corner of the island in an area bounded by Mars Bay to the west, the edge of the runway and South Red Crater to the north and almost to Pillar Bay to the east.

The fairs are dynamic but now only in the small area described. Not only do they change from one breeding season to the next but they also changed during the two weeks of this study. The Mars Bay fairs increased in size from approximately 1 hectare to 1.5 hectares while some of the other fairs reduced in size when large numbers of eggs were abandoned. The survey work is thus only valid for the day in which the fair was marked.

Stonehouse (1962) traces the gradual southward move of the fairs in the nineteenth century across the plains of Ascension Island to their present location. Their numbers then must have been vast. Sooty Tern eggs were collected for human consumption. In the 1830's in one week 120,000 eggs were collected and the collecting season lasted between one and two months (Hart-Davis 1972).

Sketches of the fairs exist but are not of sufficient accuracy to be used to determine the status of the terns. Packer (1968) produced a map of Ascension that shows two areas of fairs. In between Sandy Run and the wash, which runs down from South Gannet Hill to Mars Bay, Packer has marked "Sooty Tern Fairs". Now none exist and it is doubtful if they ever did in this area. The Waters Edge fairs on this map were occupied in 1990. Olson (1974) sketched two areas occupied by Sooty Terns colonies which conform to the current nesting locations. The sketch, however, does not show the individual fairs.

Ashmole (1963) on his sketch (Fig 2) identified 13 different fairs; these have been numbered. The two fairs at Mars Bay still exist but both are smaller and have moved further south. Fairs 3 and 7 have disappeared as a result of the runway extension. It should be noted that the alignment of the runway on the sketch map is incorrect. Fairs 4, 5 and 8, which Ashmole called First Fair, are no longer occupied. There is much more vegetation now covering the area where they were and this might be why they were abandoned. Fairs 6,9,10,11,12 and 13 were occupied in March 90, but are of different size. The area of First Fair was 0.53 hectares in 1958. Its area together with the other 12 fairs was measured on the sketch map. By using the ratio of the two areas for First Fair as a rough approximation, the areas of the other fairs were determined. The total area of the fairs was 22 hectares. This figure is not sufficiently accurate to be used as a base line but does help with finding a trend.

During the two weeks the expedition spent on Ascension 14 fairs were located, named and surveyed (Figs 3 & 4). The expedition visited nearly every part of the island and the area between Mars Bay, South Gannet Hill, South Red Crater and Pillar Bay was carefully searched. Any fairs that were missed are likely to be very small (< 200). No Sooty Terns were seen on Boatswain Island

Each fair was surveyed separately. Cairns of rock approximately 0.6m high and circled with a strip of white plastic were built around the perimeter. The cairns were built every 20 - 30 metres or at each change of direction of the fair. Terns nested within a metre of each cairn. The edges of the fairs are not symmetrical and the cairns marked out the mean perimeter edge.

A circular compass and pace or compass and tape traverse was run between the cairns and closed back on the starting point. Forward and reverse bearings were taken with a mils prismatic compass. In some cases the distances were paced twice as a check. A description sheet was produced for each fair.

All these fairs were densely packed with Sooty Terns. The exception was Fiona fair, number 3 on the map (Fig 4), which was only densely packed at the southern end. The centre and the northern end of the fair contained about 20 small nesting sites surrounded by unoccupied ground.

The traverses were then plotted on Chartwell 1mm square graph paper at a scale of 1/2400. The closing errors were measured from the plot and an accuracy for each survey determined. The average closing error was 1/70. The area for each fair was determined using mid ordinate rule. The total area of all 14 fairs is 13.5 hectares, a significant reduction on the 1957/59 estimate.

Two further sites (obvious from the guano deposits) lying between South Red Crater and Pillar Bay were marked on the map but their area was not determined as they were unoccupied during the period 9- 22 Mar.

Frigate I & II, Big John and Mars Bay I & II had identifiable physical features close to them which allow accurate identification of the site on a map. Much additional survey work was required to tie the other fairs together and fix their position precisely. As well as the standard 1:25,000 DOS map sheet series G892 Ascension, maps of scale 1/2400 exist for the whole island. Six of the 50 Topo sheets in this series, which were produced in 1962, were joined together to cover the whole of the area currently occupied by the Sooty Terns. The fairs were then plotted on the map which was then reduced in scale.

The phase of the breeding cycle when the survey took place is critical for determining the total number of Sooty Terns. The surveys were carried out during the last half of the 29 -day incubation period. Laying in this breeding cycle started in or just before 9 Feb, (Lowry 1990). As each fair was occupied eggs were laid the same day. The first chicks to hatch were seen in Frigate fair on 12 Mar, and at Doc fair on 18 Mar. The period in which the survey was undertaken is likely to coincide with the period when the maximum numbers of Sooty Terns are present in the island. The 42nd day after laying commences is the time when the density of nesting terns is at its maximum (Ashmole 1963).

The qualitative data gathered so far indicates a reduction in the size of the fairs and a downward trend in the number of Sooty Terns breeding on the Island. These data give a total of approximately 174,400 eggs so that the breeding population in this period can be estimated as about 350,000 birds. To confirm this, what now remains to be done is to repeat the whole operation at some time in the future. Then for the first time it will be possible to determine precisely the status of the Ascension Sooty Terns.

FERAL CAT PREDATION ON SOOTY TERNS ON ASCENSION ISLAND by J.G.Walmsley

Introduction

Feral cats, *Felis catus* have been known to prey upon the breeding seabirds of Ascension Island for over 170 years. During this time they have succeeded in eliminating all breeding seabirds, with the exception of the Sooty Tern *Sterna fuscata*, and five species of land birds. All other seabirds are confined to the small offshore Boatswain Bird Island, 300 metres from the main island off the south east coast, and to inaccessible cliffs and offshore stacks. The number of feral cats on the island is unknown, but one cat to every thousand Sooty Terns was a figure put forward by Ashmole (1963).

During the limited time we spent on Ascension, quantitative data was collected on predation by cats on adult terns, up until the time the chicks hatched. This period represents the "night club" activities, the onset of egg - laying, and the establishing of breeding colonies or "fairs". Complementary information on cat kills was obtained from Mars Bay and Big John fairs up to the time of our departure.

Methods

Signs of predation on colonies is characterised by the numerous corpses (wings, tails, heads) of adult birds scattered about the breeding fairs, or in heaps at favourite eating places around their perimeter. Cat scats and tracks are also common in the sandier or fine ashy areas.

Corpses and remains were collected by an RAF /BBC team from breeding sites first occupied from mid -January to mid -February (Fig:-§). A second collection began after the arrival of the expedition. The aim was to clear all the breeding fairs of corpses, making sure that only those birds killed during the current breeding season were counted. Dried corpses and bones from previous seasons littered the fairs, but these were omitted from the count. Once the fairs had been cleared, collections were made every two days at Mars Bay and Big John to try and assess the daily cat kill. All the corpses were put into plastic bags and taken away to be burned.

Results

At the start of each breeding season the terns form "Night Clubs" on the breeding grounds. This activity probably began in mid -January when birds were calling during the night over the airfield. It is also the time when cats are extremely hungry and many birds are killed. The first corpses were collected from the main fair on 23 Jan (Fig.6). By 3 Feb 261 had been killed by cats, and thousands of birds were seen apparently abandoning the main fair for a new site where an estimated four to five thousand were counted on the ground.

Mars Bay fair was first occupied on 8 Feb (F.Lowry pers corn). On 7 Mar several thousand birds were present and many corpses were seen scattered around the perimeter of the colony.

During the period 23 Jan to 15 Feb a total of 407 corpses were collected and buried under piles of stones by the RAF /BBC team. The number of corpses collected per visit is given in Figure 6. Two cat traps were also reported to have been set at the edge of one fair.

A clean -up of corpses from all the fairs began after the arrival of the expedition members on 9 Mar, and the operation was completed during five visits. The numbers of birds collected per visit for the period 10 -15 Mar are given in Figure 6, when 2393 corpses were collected. This figure should be taken as a minimum number killed, as some corpses may have been taken well away from the fairs before being eaten.

After the initial clean -up of the fairs we continued to collect corpses from two sample fairs so that we could have some measure of the number of cat kills per day. Mars Bay fair was an obvious choice because of its isolation from the others, and Big John was chosen because it was the first to be reached after the runway, and was easily accessible. These two were visited on alternate days beginning in Mars Bay on 14 Mar and ending in Big John on 21 Mar, thus allowing for four visits to each. The dates of each visit together with the number of cat kills per two -periods are given in Figure 7.

On examining the results there would appear to be a heavier predation by cats in Mars Bay fair (21^1 arithmetic mean) cat kills per two day period) than in Big John fair (10^1 cat kills per two day period). The reason for this may be due to cat densities at the start of the breeding season and their distribution throughout the fairs as the season progresses. We can predict that cats will be more concentrated in areas where night clubs are formed, and that an important number of terns will be killed. However once breeding colonies are established cats may disperse and be diluted around the fairs. Cat densities in anyone fair may depend not only on easy access to food (i.e. incubating birds) but may also be determined by the available hiding places they can retreat to during the heat of the day. Thus cat kills may vary between fairs and be more prevalent in one than in another.

Systematic collections of corpses throughout the breeding season would of course give more precise information on the numbers killed by cats. It is possible however, that these counts may be continued in the two sample fairs by other teams, at least during part of the current season. The information obtained can then be used as a basis for future studies.

A final total of 2924 adult terns were killed by cats on Ascension Island from the onset of breeding, up to the time of chick hatching.

Figures 3 & 4 show the approximate number and distribution of all fairs during the time of our visit to Ascension.

Other Forms of Predation

Predation of chicks by Frigate Birds

The hatching period of Sooty Terns on Ascension is announced by the increasing activity of the endemic Ascension Island Frigate Bird, *Fregata aquila* patrolling over the Sooty Tern fairs.

On 14 Mar I observed predation of chicks by Frigate Birds. The method used by the Frigates was to patrol into the wind 10 - 20 metres above a fair, all the while observing the incubating terns. Whether the Frigate selected a victim at random, or certain movements made by a sitting bird indicated that it had a chick I don't know. Once a victim was chosen the Frigate would swoop low, and while still in flight lift up the adult bird by the bill or head, and drop it to one side without apparently causing it the slightest harm. The next instant the Frigate had snatched up the uncovered chick and swallowed it whole. This action was repeated over and over again; some times the Frigate would be harassed by the terns and driven off, or distracted from its victim. We aptly named this colony Frigate fair. During the next few days the Frigates had extended their patrols to Doc I and II fairs. This type of predation by Frigates may occur only during the first few days after hatching when the chicks are very

¹ represents the arithmetic mean.

small. Ashmole(1963) states that "normally, only chicks which are alone in the open are taken", suggesting that the chicks he observed taken were probably much older and capable of hiding in the rocks.

Land Crabs

Terrestrial Land Crabs, *Gecarcinus lagostoma* of Ascension occur in two colour forms; yellow and purple. They are found all over the island from sea level up to the top of Green Mountain at 939 metres.

Those which occur in the fairs probably exert a certain type of disturbance predation, particularly on the eggs. Eggs showing signs of crab claw marks were found in almost all the fairs, especially in areas where eggs had been abandoned.

Land crabs are usually considered to be scavengers and grazers. They are also known to predate upon eggs and chicks of terns, petrels, and boobies whenever the opportunity arises (Atkinson 1985) .What influence land crabs have on the breeding terns of Ascension is not known, and needs further investigation.

Indian Mynah

One of the land bird species on Ascension, the introduced Indian Mynah, *Acridotheres tristis* occurs in many parts of the island from sea level up to the high slopes of Green Mountain.

Their presence in the fairs was intriguing until it occurred to me that they were predated on eggs. If this is true, Mynahs may have been responsible for some of the predated eggs found with marks other than those we attributed to and crabs or rats. Indian Mynahs were observed on several occasions in fairs during our visit, and only on one occasion did I suspect that they were eating eggs.

On the island of St.Helena 1350km south-east of Ascension Island, Indian Mynahs are also known to take eggs or young of the St.Helena Plover *Charadrius sanctaehelenae* (Hayman et al. 1986).

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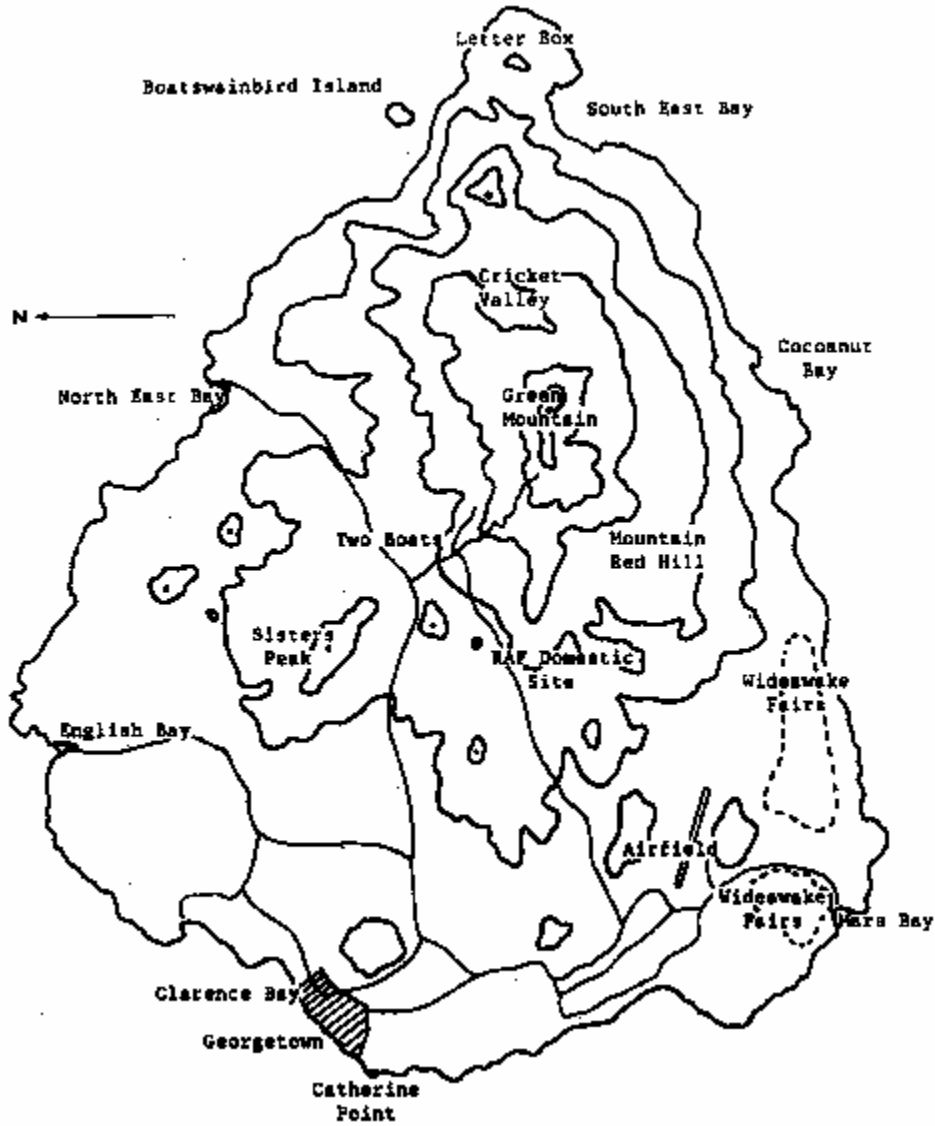


Figure 1: Ascension Island

TABLE 1: THE STATUS OF RESIDENT BIRDS ON ASCENSION ISLAND

Maderian Storm Petrel *Oceanodroma castro* Breeds on BBI. BOU Exped 1957/59 estimated population of 3000. No more recent counts are available.

Red -billed Tropic Bird *Phaethon aethereus* Breeding confined to BBI Letterbox and Pillar Bay. c 30 pairs but count difficult as birds spend much time in nest crevices.

Yellow -billed Tropic Bird *Phaethon lepturus* Much more widespread; breeds all round the island. c 300 pairs.

Masked Booby *Sula dactylactra* Breeding confined to top of BBI. We had a max count of 6385. Would probably breed elsewhere if cats predation ceased.

Brown Booby *Sula leucogaster* Breeds offshore around the island. c 1000 counted.

Red Footed Booby *Sula sula* Breeds on BBI. c 10 pairs both White and White Tailed. Brown morphs seen.

Ascension Frigate Bird *Fregata aquila* Breeds only on the top of BBI. There we had a max count of 2400 birds. There are also small roosts on the cliffs of Letterbox.

Brown Noddy *Anous stolidus* Breeds on stacks and cliffs around Ascension, but apparently not on BBI. Numbers appear to be about 1000.

Black Noddy *Anous tenuirostris* Breeds on the cliffs of BBI where we counted a maximum of 7500. This count was made from a boat mid morning and certainly under- records the numbers present.

Sooty Tern *Sterna fuscata* Breeds in large colonies or fairs near the airstrip. Population estimated to be c 340,000.

White Tern *Gygis alba* Breeds on BBI, sea and inland cliffs, and reportedly in Eucalyptus trees. Estimated numbers are 600 but this could be low.

Red -necked Francolin *Ptemistes afer* Lives in acacia/guava scrub on the middle to lower slopes of Green Mt. We saw parties of up to four. Uncommon and shy.

Mynah *Acridotheres tristis* Not censured. Parties of 85 seen at Two Boats. Total population estimated to be 1000 + .

Red -cheeked Waxbill *Estrilda astrild* Not censured. Common on grassy areas where flocks of up to 100 were observed.

Canary *Serinus flaviventris* Not censured. Most abundant in stands of Casuarina Trees where small parties could be found. Less common than the Red -cheeked Wax bill.

House Sparrow *Passer domesticus* Introduced to Georgetown in 1986 where there is now a small breeding colony.

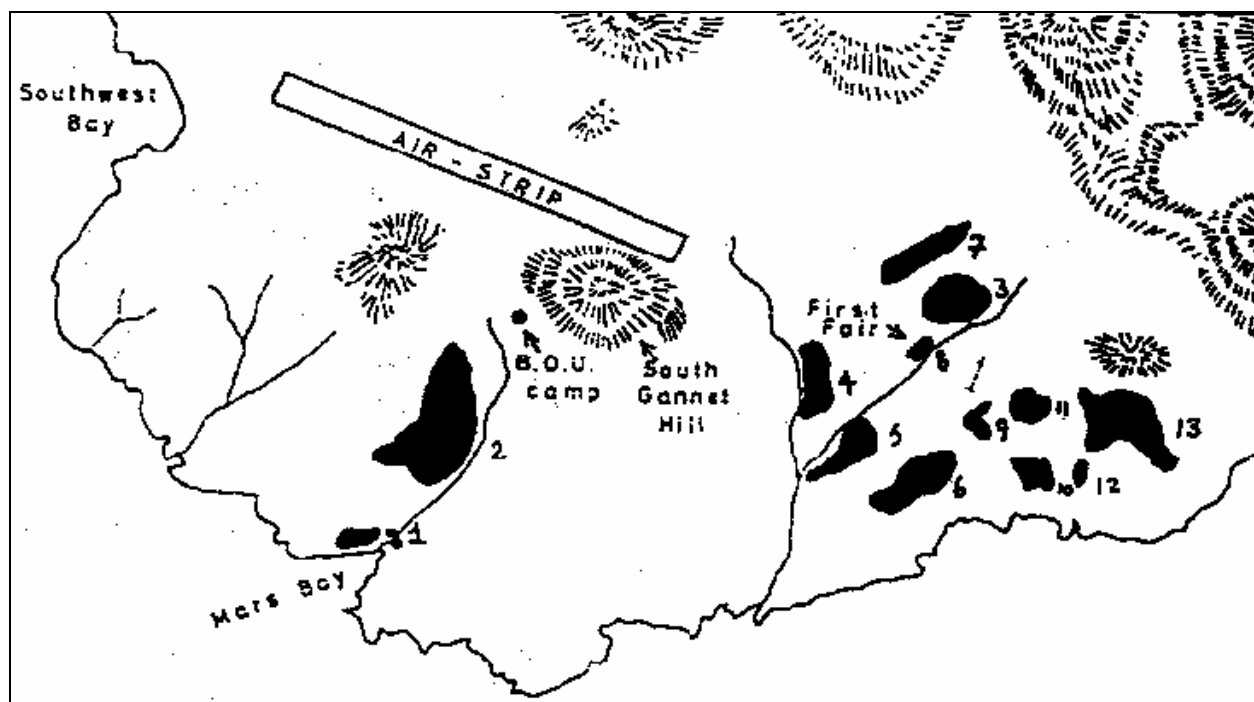


Figure 2: Sketch map of the south west corner of Ascension, showing the approximate areas occupied by the nesting colonies of Sooty Terns in the 1958/59 breeding period (black areas).

TABLE 2: SUMMARY OF THE FAIRS ON ASCENSION ISLAND MARCH 1990

FAIR No	FAIR Name	Local Grid Ref	Height Metres	Perimeter Survey Accy	Area Hectures	Est.of Eggs ²
Mars Bay Fairs						
1	MB I	662 173	15	1/30	1.35	20,200
2	MB II	661 172	8	1/120	0.15	2,200
Airfield Fairs						
3	Fiona	682 173	24	1/130	5.46	27,600
4	Small	687 173	30	1/10	0.02	100
5	Infill I	690 175	20	1/10	0.12	600
6	Infill II	691 174	20	1/10	0.08	400
7	Big John	689 175	44	1/35	1.91	35,500
8	Gez	691 176	38 – 43	1/150	2.85	52,000
9	Little John	692 173	17	1/50	0.14	3,200
10	Richard	694 176	38	1/30	0.06	1,400
11	Doc I	694 172	18	1/60	0.28	6,400
12	Doc II	694 174	30	1/120	0.53	12,200
13	Frigate I	695 172	15	1/170	0.11	2,500
14	Frigate II	697 172	24	1/60	0.44	10,100

Average Accuracy 1/70: Total Area 13.5 Hectares: Total Eggs 174,000

² The estimate of the number of eggs in each fair was produced by Dr N.P.Ashmole from his transect data and this survey information.

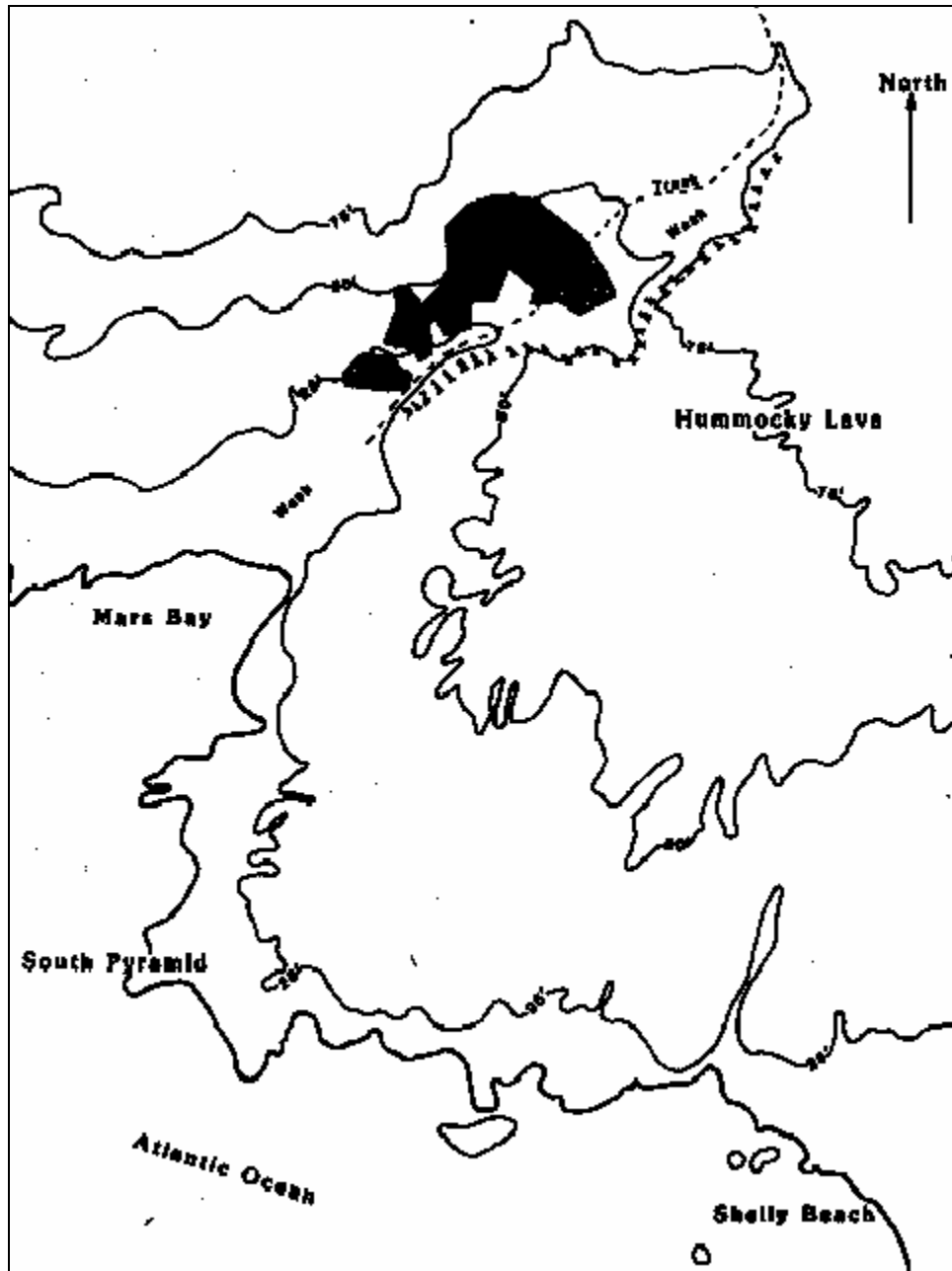


Figure 3: Location and Size of Mars Bay Fairs in March 1990

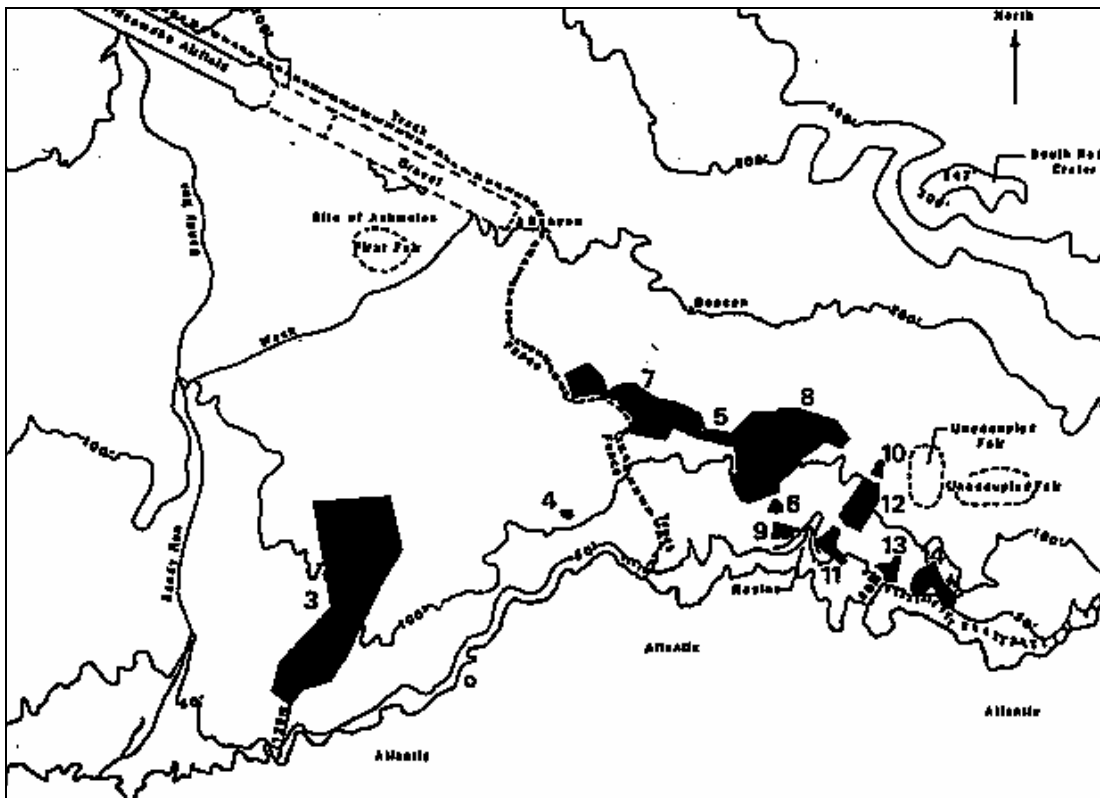


Figure 4: Location and Size of all other Wideawake fairs (Less Mars Bay) in March 1990

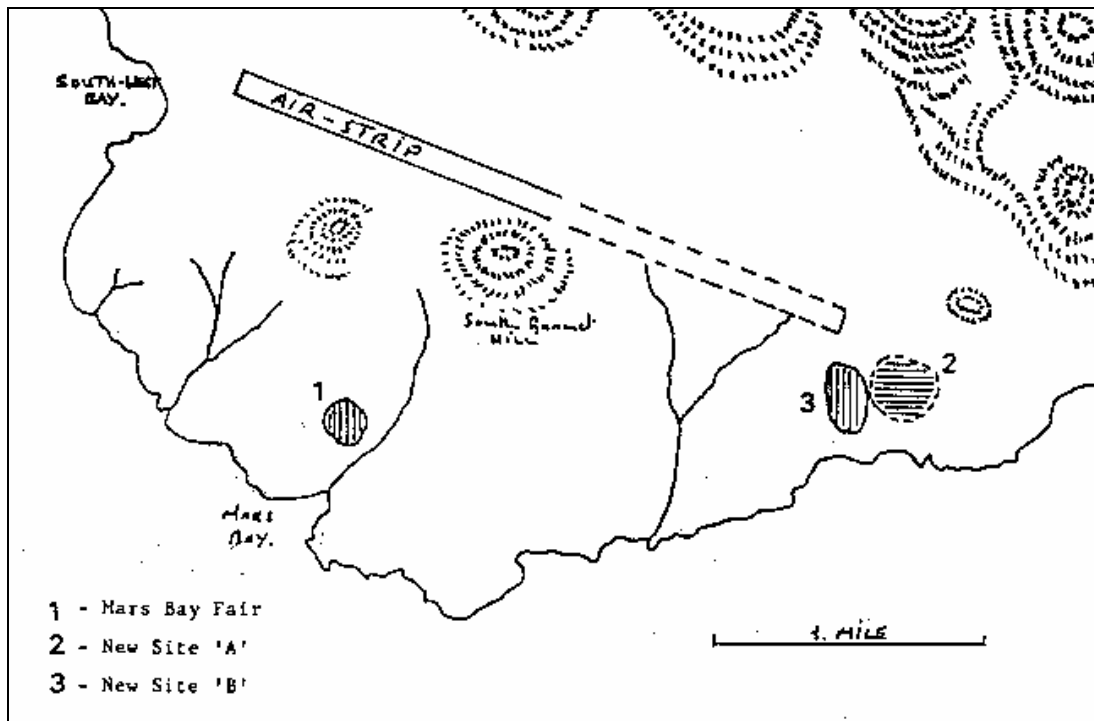


Figure 5: Distribution of Wideawake 'Night Clubs' in January and February 1990

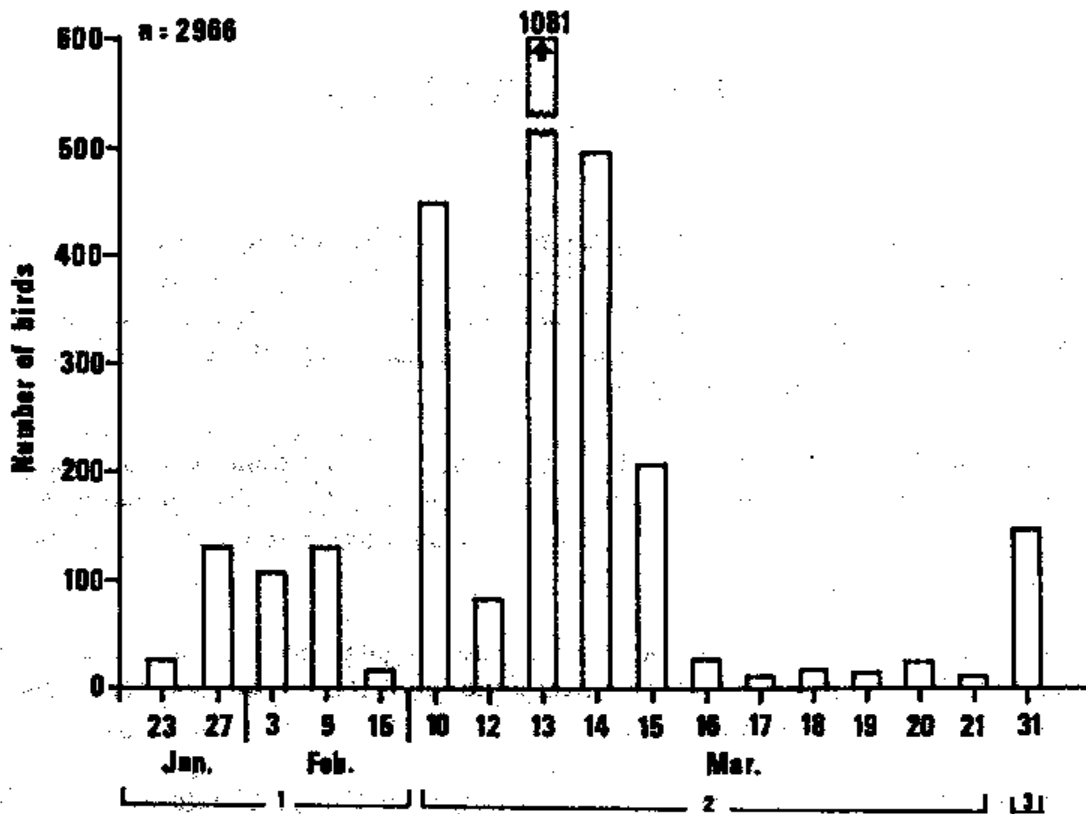


Figure 6: Collection of Wideawake corpses on Ascension Island in 1990

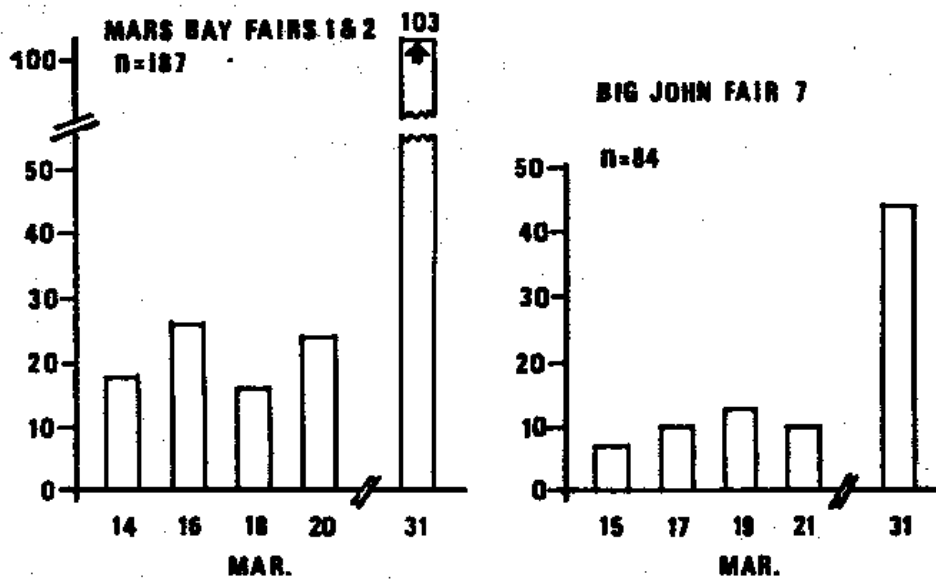


Figure 7: Number of Cat Kills from 2 sample fairs between 10 – 31 March 1990