

THE STATUS AND DISTRIBUTION OF  
FEA'S PETREL *PTERODROMA FEA*  
IN THE CAPE VERDE ISLANDS

*STATUS EN VERSPREIDING VAN DE GON-GON  
PTERODROMA FEA OP DE KAAPVERDISCHE EILANDEN*

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*A census of Fea's Petrel was conducted in the Cape Verde Islands during January and February 1998. Counts were made on three of the four islands where the taxon has historically been known to breed: Fogo, São Nicolau and Santo Antão. The persistence of those colonies previously reported on these islands was confirmed and several undocumented colonies were located. The population on Fogo was c. 80 pairs, on São Nicolau c. 30 pairs and that on Santo Antão c. 200 pairs. The surveys of Fogo and Santo Antão were incomplete, so the population size could be higher there than indicated by the present data. No survey of Santiago was attempted and further surveys are needed to establish the status of Fea's Petrel in the Cape Verde Islands as a whole. The colonies on Santo Antão and São Nicolau were generally situated on inaccessible cliff faces above dry river valleys, while those on Fogo were among boulders in dry river beds, among rubble and tubes in old lava flows and on cliffs. Fea's Petrel continues to be threatened by human exploitation and predation by cats and rats, particularly on Fogo and some areas of Santo Antão where the colonies are most accessible.*

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## INTRODUCTION

The taxonomy of the gadfly petrels of the genus *Pterodroma* that breed on islands in the north-east Atlantic has for long been a source of controversy. Salvadori (1899) named and described *Oestrelata* (= *Pterodroma*) *feae* from the Cape Verde Islands and found it specifically distinct from *P. mollis* of the

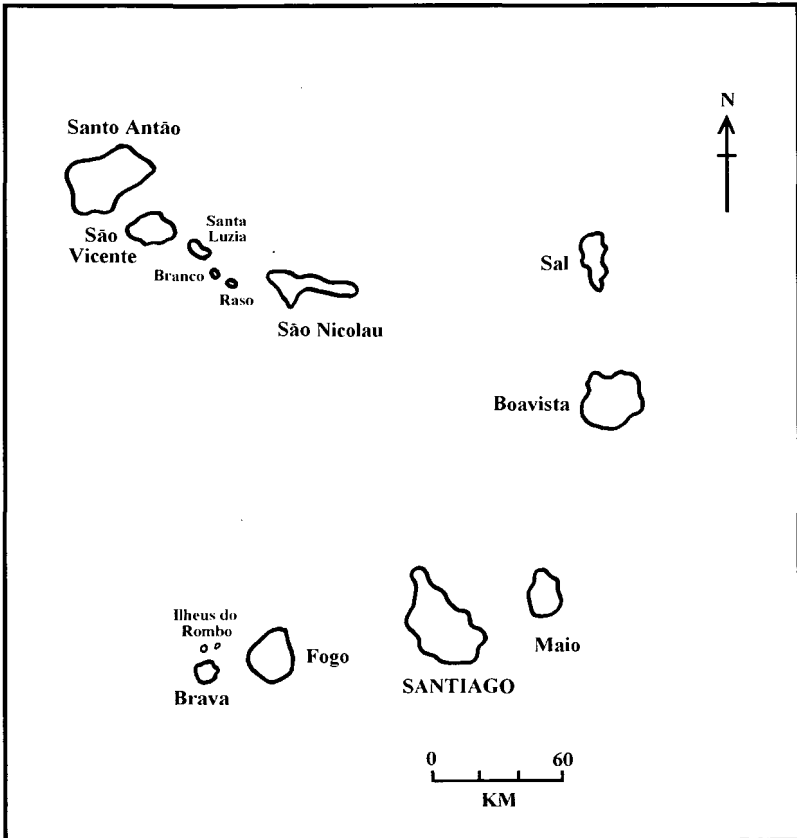


Figure 1. Cape Verde Islands.

Figuur 1. Kaapverdise Eilanden.

southern oceans. Based on phenetic criteria, the populations from mainland Madeira and the Desertas were separated by Mathews (1934a, b) as 'subspecies' *madeira* and *deserta*, respectively. For much of this century, all of these north-east Atlantic forms have been treated as conspecific with Soft-plumaged Petrel *P. mollis* (e.g. Bourne 1957; Vaurie 1965; Cramp & Simmons 1977; Jouanin & Mougouin 1979), although Murphy (1967) cautiously noted that "the relationship of all of these [east Atlantic forms] with the circumpolar antiboreal petrel, *P. mollis mollis*, is likely to prove more remote than suggested by current nomenclature".

In recent years, a consensus has emerged to assign *P. madeira* and *P. feae* (including *deserta*) specific status (e.g. Bourne 1983; Imber 1985; Zino &

Zino 1986). Recent phylogenetic analyses of *cyt-b* mtDNA sequences have shown that North Atlantic taxa comprise a distinct clade not closely related to *P. mollis*, with which it does not even share a sister-taxon relationship (Nunn & Stanley 1998; Nunn & Zino in press).

As no blood samples of *feae* from the Cape Verde Islands were available for these studies, its taxonomic relationship to other north Atlantic gadfly petrels, in particular *deserta*, remains unresolved. However, differences in their morphometrics (Bretagnolle 1995; Snow & Perrins 1998), their different breeding phenology (laying in December-January on Cape Verde, July–August on Desertas; Cramp & Simmons 1977) and the distance between breeding sites strongly suggest that these two taxa are effectively reproductively isolated through philopatry and are probably cryptic species. Further phylogenetic analyses are necessary to test this hypothesis and elucidate the position of *P. feae* (*sensu stricto*) within the clade of north Atlantic *Pterodroma* petrels.

Irrespective of taxonomy, *P. feae* (*sensu lato*) is a Macaronesian endemic that is classed as globally threatened (Collar *et al.* 1994) and vulnerable (Hazevoet 1996; Stattersfield *et al.* 1998). In Cape Verde, it breeds in the mountainous interior of the islands of Santo Antão, São Nicolau, Fogo and Santiago (Hazevoet 1994, 1995). The population on the Desertas is confined exclusively to Bugio islet (off Madeira) where it breeds mainly in deep burrows in the soil-capped plateau (Jouanin *et al.* 1969; Zino & Zino 1986; Zino & Biscoito 1994). Birds similar to Fea's Petrel have also been reported from two small islets in the Azores (Bibby & del Nevo 1991; Monteiro & Furness 1995) so a tiny breeding population may exist there. In addition, gadfly petrels have also been heard calling on Great Salvage island during 1983 (James & Robertson 1985), but have not been recorded subsequently despite the presence of wardens.

The breeding population on Bugio islet is considered to be around 150–200 pairs and appears to be stable (Jouanin *et al.* 1969; Zino & Zino 1986; Zino & Biscoito 1994; Zino *et al.* 1996). In contrast, little is known about the location of breeding sites or status and trends of the population in the Cape Verde Islands. The only information available are notes on the locations of a few nests, records of sites at which museum skins were collected and anecdotal information gained from local people (summarised by Hazevoet 1995). Based on this information, the approximate locations of some colonies were established and the population size was estimated to be between 500 and 1000 pairs (Hazevoet 1995). However, such information is inadequate as a basis for assessing population status and trends.

A survey of Fea's Petrels in Cape Verde was clearly a high priority in order to establish the status and distribution of this vulnerable Atlantic seabird. An expedition was therefore mounted in 1998 with the aim of locating the

breeding colonies of Fea's Petrel on Fogo, São Nicolau and Santo Antão and to estimate the number of pairs on each of these islands. This paper presents the results of this survey, discusses their implications for conservation and makes recommendations for further survey work.

## METHODS

The Cape Verde Islands comprise 10 islands and several islets of volcanic origin situated off north-west Africa (14°48' to 17°22'N and 22°44' to 25°22'W). The three islands surveyed for Fea's Petrel were Fogo (NR, PO, AV, CJH), São Nicolau (NR, CJH, LRM) and Santo Antão (FZ, PO, AV, HCN, EAZ) (Fig. 1). Due to lack of time and resources, no attempt was made to survey Santiago, the only other island in the archipelago where Fea's Petrel has been found breeding. The survey was timed to coincide with the incubation period, fieldwork being conducted between 11 January and 20 February 1998. Surveying on Fogo took place between 11 and 31 January, on São Nicolau between 1 and 20 February, and on Santo Antão between 26 January and 12 February.

**Areas surveyed** A truly systematic survey of each island would have been impossible in the time available, so none of the island surveys can be regarded as comprehensive, although coverage of suitable habitat on São Nicolau was almost complete (see below). Sampling densities and extrapolation to the area of suitable habitat was also impossible owing to insufficient knowledge of habitat characteristics. The survey therefore aimed to survey as many colonies as possible and produce an absolute minimum estimate of population size and distribution. Despite the limitations of minimum estimates these represent a considerable advance on previous information.

For each island, areas where breeding birds had been located in the past were targeted initially and the search was then extended to adjacent areas of similar habitat. Results should therefore be regarded as conservative estimates of distribution and status since some colonies may have been missed. Dialogue with local people was often essential for establishing the approximate locations of breeding sites prior to initiating surveys. Fea's Petrel is known as "gon-gon" on Fogo and São Nicolau and "biôrro" on Santo Antão. We asked people if they were familiar with the birds and, if so, where they nested, roughly how many there were, whether numbers and distribution had changed, and what factors may have contributed to any declines. All information was checked by survey work wherever possible.

Colonies were located by listening for the birds distinctive moaning calls at points adjacent to suitable sites. Survey work was conducted between 20:00h and midnight, the time when petrels return to their colonies and calling

intensity is greatest. The calls can be heard up to 1 km away in favourable weather and topography (pers. obs.). The locations of any breeding sites identified during nocturnal surveys were marked on a 1:25 000 topographical map.

**Population estimates** The colonies on Santo Antão and São Nicolau could not be reached on foot because the birds bred in cavities in precipitous cliffs and pinnacles. Most of the breeding sites on Fogo could be accessed with some difficulty, but the nest sites were dispersed and difficult to find, so merely counting nests would have produced a marked under-estimate of abundance. Therefore, the only survey method available was that used by Wingate (1964) to survey Black-capped Petrel *P. hasitata* colonies on inaccessible cliffs in Haiti. This involved comparing nocturnal calling intensity at these colonies with that of the colony of the closely related Cahow *P. cahow* in Bermuda, where the number of breeding pairs was known. In this survey, the calling intensity of Fea's petrel colonies in Cape Verde was scored relative to the colonies of *P. madeira* in Madeira that has 20-30 breeding pairs and that of *P. f. deserta* on Bugio that has 150-200 breeding pairs (Zino & Biscoito 1994). This was used to develop the following ordinal score of the number of pairs at a breeding site (range in parentheses):

- 1 No calls: no pairs present;
- 2 Calls infrequent, never more than two birds calling at one time: c. 2 pairs (1-4);
- 3 Calls more frequent, intensity lower than that in the *P. madeira* colony: c. 10 pairs (5-15);
- 4 Intensity of calling similar to that in the *P. madeira* colony: c. 25 pairs (16-35);
- 5 Calling intensity higher than that in the *P. madeira* colony, but less than in the *P. deserta* colony: c. 50 pairs (36-100).

Most of the vocalisations at petrel colonies are made by pre-breeding birds (Warham 1996), so this method assumes that the size of the pre-breeding and breeding populations at a colony are correlated. The method also assumes that the calling intensity of the petrel colonies on Madeira are similar to those in Cape Verde. The estimates are therefore at best a crude index of status and relative abundance of the colonies.

Nocturnal surveys were conducted only on moonless nights on Fogo and São Nicolau because Fea's Petrel seldom calls in moonlight (Zino & Zino 1986). The largest colony at Cha das Caldeira was almost completely silent on moonlit nights but very vocal once the moon had set. Due to time constraints on Santo Antão, some surveys were conducted on moonlit nights, so when calls were detected at breeding sites here numbers will be under-estimates; such moonlit surveys are not recommended for future surveys.

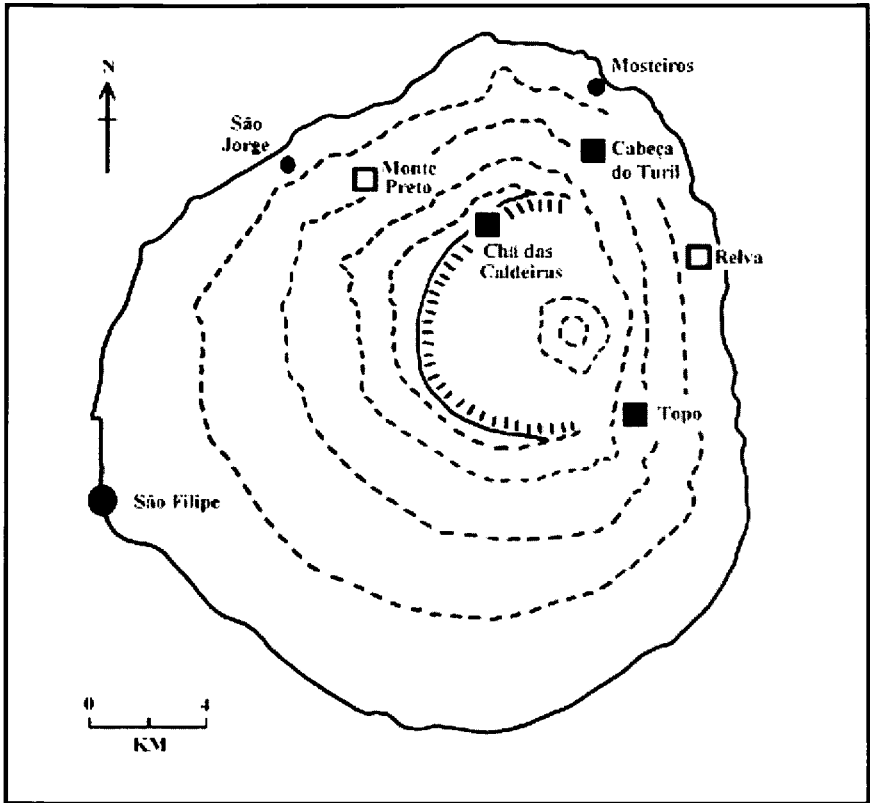


Figure 2. The distribution of Fea's petrel on Fogo. Filled squares represent confirmed Fea's petrel colonies and open squares represent places where colonies were reported to exist but were not confirmed by survey work. Main settlements are shown as filled circles. The dashed lines represent contours with a 500 m interval.

Figuur 2. De verspreiding van Gon-gons op Fogo. Zwarte vierkantjes geven bevestigde kolonies aan, open vierkantjes geven kolonies aan waarvan het bestaan niet tijdens dit onderzoek kon worden bevestigd. Dorpjes zijn weergegeven als zwarte stippen. Gestippelde hoogtelijnen (500m intervallen).

## RESULTS

**Fogo** The entire crater wall of the Chã das Caldeiras (Fig. 2) was searched at night for breeding sites of Fea's Petrel, but these were found only in the area around the village of Bangureira. Birds were heard calling from three of the four

dry river valleys in the caldeira wall, with each having *c.* 2 pairs. The other river valley appeared to be suitable for breeding but several nocturnal searches failed to locate any calling birds. A search of this valley during the day located the remains of three adult birds that had been eaten by cats. An incubating bird was found in a cavity under a boulder in the bed of one of the dry river valleys and several apparent breeding burrows were in similar habitat. Two colonies were also found in cliffs just below the crest of the crater wall, one with *c.* 10 pairs and the other with *c.* 25 pairs. The birds were probably nesting in the many cavities that occurred in these cliffs, but a search failed to find any conclusive evidence of this.

Two more colonies were found in old lava flows at Topo and Cabeça do Turil (Fig. 2), each of which held *c.* 10 pairs. Birds were nesting in cavities among basalt rubble and tunnels on gently sloping ground, a habitat that occurs around most of the north-eastern quarter of the island. No other areas on Fogo were searched, although we were informed that there were colonies similar in size to those at Topo and Cabeça do Turil at Monte Preto and Relva (Fig. 2). As received information was accurate for all the other sites surveyed, it is likely that colonies of around 10 pairs exist there. From this survey we would estimate that the population size on Fogo is approximately 80 pairs, although it is possible that more colonies exist on the slopes around the island.

**São Nicolau** Breeding sites were found at three locations in the mountains of São Nicolau (Fig. 3). All of these colonies were relatively small with *c.* 10 pairs each. The colonies were situated on the cliffs of Monte Deserto above Canto, on the pinnacles of a ridge off the north-west slopes of Monte de Sentinha and on the easterly cliffs of the ridge between Ribeira Funda and Ribeira da Covoada (Fig. 3). All were located on inaccessible cliffs so closer inspection was impossible. As nocturnal coverage of the central highlands of São Nicolau was almost complete it is unlikely that any other colonies occur there. The population size on the island is therefore approximately 30 pairs. Inhabitants at Canto informed us that “gon-gons” used to breed under boulders much lower in the valley but no longer did so (presumably due to human exploitation or cat predation) about two or three decades ago.

**Santo Antão** The survey of Santo Antão showed that Fea's Petrel was widely distributed on the cliffs above river valleys throughout the north and east of the island (Fig. 4). Santo Antão is a large (779km<sup>2</sup>) and mountainous island with many areas of apparently suitable habitat not all of which could be surveyed, so the survey gives a minimal estimate of distribution and abundance there.

Birds were heard calling from two sites in the cliffs along Ribeira Grande at Faja dos Cumes and near Corda, each of which had *c.* 10 pairs. Local

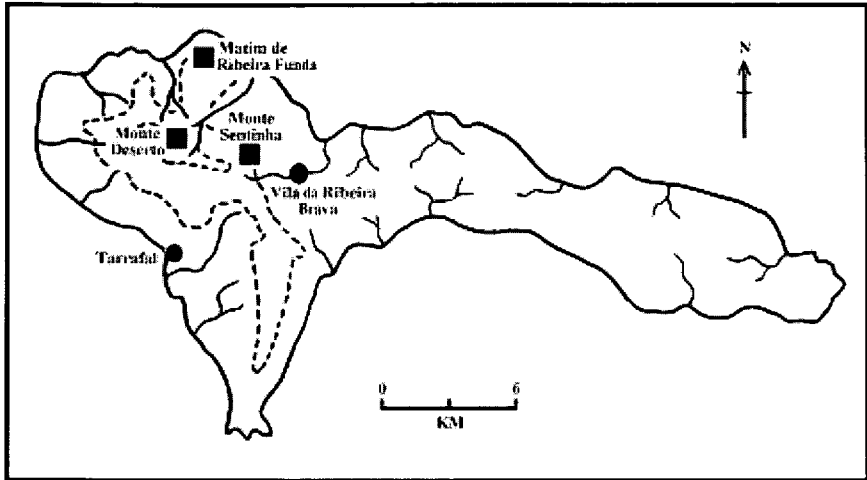


Figure 3. The distribution of Fea's petrel on São Nicolau. The location of colonies is denoted by filled squares and main settlements are shown as filled circles. The dashed lines represent contours with a 500 m interval and the solid lines represent main river valleys.

Figuur 3. De verspreiding van Gon-gons op São Nicolau. Zwarte vierkantjes geven bevestigde kolonies aan, open vierkantjes geven kolonies aan waarvan het bestaan niet tijdens dit onderzoek kon worden bevestigd. Dorpjes zijn weergegeven als zwarte stippen. Gestippelde hoogtelijnen (500m intervallen), rivierdalen als getrokken lijntjes.

people claimed to have caught birds for food at three other sites within the valley. In the adjacent river basin of Ribeira da Torre, local people were also familiar with Fea's Petrel and indicated that they were distributed throughout the high cliffs above the valley. However, only one colony with *c.* 2 pairs was found here. A second survey higher up this valley failed to detect any calling birds, although this survey was conducted in moonlight. A site with *c.* 2 pairs was found in the cliffs above Ribeira do Paúl and another of a similar size was located nearby at Aguas das Caldeiras. The cliffs above Ribeira Fria contained a colony of *c.* 10 pairs.

Three colonies with *c.* 25 pairs were located in mountains above the villages of Escabeçada, Alto Mira and above Chã da Norte at Carvoeirinho (Fig. 4) and local people at all three reported that they catch and eat Fea's Petrels. A total of five active nests was found in the colony at Carvoeirinho and three above Alto Mira, but most of the breeding sites were probably on inaccessible cliffs. The largest colony located during the entire survey was at Tope do Biórro



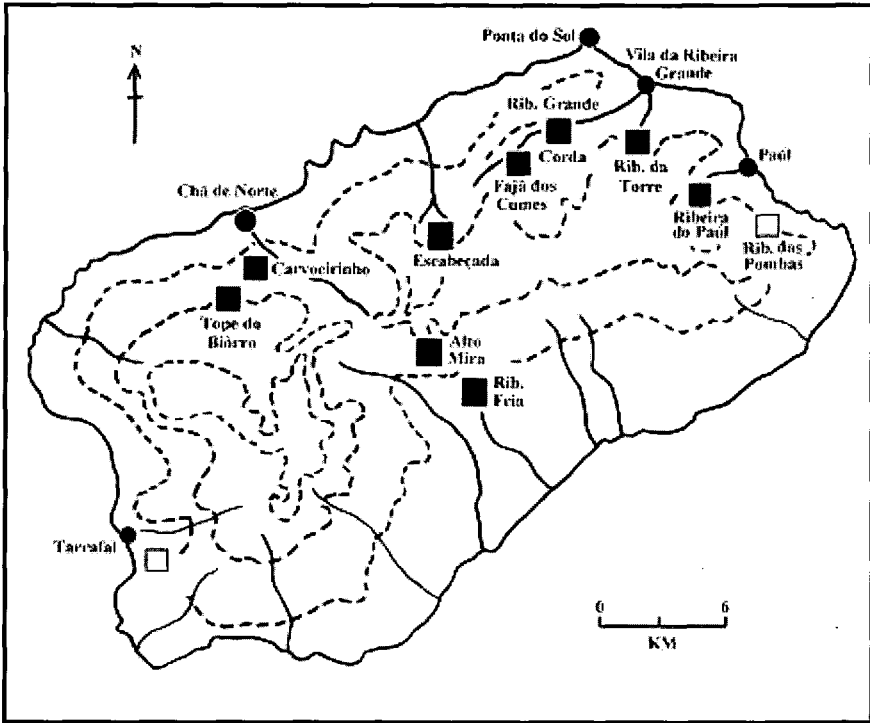


Figure 4. The distribution of Fea's petrel on Santo Antão. Filled squares represent confirmed Fea's petrel colonies and open squares represent places where colonies were reported to exist but surveys of which were conducted in moonlight and no calls were heard. The dashed lines represent contours with a 500 m interval and the solid lines represent main river valleys.

Figuur 4. De verspreiding van Gon-gons op Santo Antão. Zwarte vierkantjes geven bevestigde kolonies aan, open vierkantjes geven kolonies aan waarvan het bestaan niet tijdens dit onderzoek kon worden bevestigd. Dorpjes zijn weergegeven als zwarte stippen. Gestippelde hoogtelijnen (500m intervallen), rivierdalen als getrokken lijntjes.

(named after the bird) above the village of Chã Dura, where *c.* 50 pairs were likely to be breeding.

Surveys were also conducted along Ribeira das Pombas and in the mountains above Tarrafal, but the presence of Fea's Petrel could not be established here, probably due to a full moon during these surveys. However, local people in these areas gave a good impression of Fea's Petrel calls and said that they had caught them for food, so their presence at these sites is likely.

Given that the survey was incomplete and some surveys were conducted during moonlight and had little chance of detecting colonies even if they were present, the status of Fea's Petrels on Santo Antão is difficult to establish. However, approximately 150 pairs were located and further colonies were likely to exist, so there is little doubt that Santo Antão is the most important island for breeding Fea's Petrels in the Cape Verde archipelago. We would suggest a population of 200 pairs on Santo Antão might be a conservative estimate.

## DISCUSSION

Although incomplete, this survey has provided valuable information on the distribution and relative abundance of Fea's Petrel on three of the four Cape Verde Islands where historically the taxon has been known to breed. The continued presence of the colony, first reported by de Naurois (1969), at the Chã das Caldeiras on Fogo was confirmed, despite concerns that a volcanic eruption in 1995 may have destroyed it. In fact, lava flows from that eruption were 200 m below and 1 km from the nearest nesting area. This survey also found that the colonies previously reported at Ribeira Grande, Ribeira do Paúl and Alto Mira on Santo Antão and at Canto on São Nicolau (de Naurois 1969; Hazevoet 1995) were still extant. On all of the islands surveyed, previously undocumented breeding sites were identified.

The population estimate for São Nicolau was *c.* 30 pairs, for Fogo *c.* 80 pairs, and for Santo Antão *c.* 200 pairs and it is likely that more colonies exist on Fogo and Santo Antão. It is clear that Santo Antão is the most important island for breeding Fea's Petrels. Previous reports had suggested Fogo held the largest breeding population (Hazevoet 1994, 1995), highlighting the unreliability of old records and anecdotal information. The importance of Santo Antão as a breeding colony explains why numbers seen at sea near there have been considerably higher than those near the other islands. More than 120 Fea's Petrels were counted at sea along the northern coast of Santo Antão during the afternoon of 8 March 1996, while sea-watches along the northern coast of São Nicolau on 14 and 16 March 1996 yielded only *c.* 10 birds on both dates (Hazevoet 1997). In addition, during the morning of 26 February 1999, at least 50 were seen off Ponta do Sol, northern Santo Antão, while *c.* 300 were counted there the afternoon of the same date (S. Haavisto, pers. comm.). No such reports of large numbers at sea are known from anywhere else in the archipelago.

Based on the present survey, the total breeding population in the archipelago is probably between 500 and 1000 breeding pairs, a figure that agrees with the earlier estimate by Hazevoet (1995). However, this estimate is an absolute minimum as further colonies almost certainly exist on Fogo and

Santo Antao and Fea's Petrel has also been found breeding in the central mountain range of Santiago (de Naurois 1969; Hazevoet 1995) which was not surveyed during this expedition. More visita to Fogo, Santo Antão and also Santiago are needed to explore unsurveyed areas so that undiscovered colonies may be located and their status assessed. In this manner, a comprehensive picture of status and distribution of Fea's petrels on Cape Verde might be built up over time. Future expeditons should also revisit the colonies described in this report so that their persistence can be monitored.

The population of Fea's Petrel in the Cape Verde Islands is probably smaller and its distribution more restricted than in the past and this has been blamed on soil erosion due to overgrazing by goats, human exploitation and predation by cats and rats (Collar & Stuart 1985; Hazevoet 1994).

Human exploitation, first reported by de Naurois (1964), still continues. On Santo Antão there is a strong culture of eating wild birds, and people admitted to eating Fea's Petrel adults, eggs and chicks whenever they could obtain them. A recently published Santo Antão cookery book lists many avian delicacies of the island, and especially recommends recipes for "biörro", "cagarra" (*Calonectris edwardsii*) and "pedrêr" (*Puffinus [assimilis] boydi*). According to residents of the Chã das Caldeiras and Topo, several birds are still taken every year for pseudo-medicinal purposes on Fogo, with the fat of the birds being used as a folk remedy for aches and rheumatism, as previously documented by de Naurois (1964). The current level of human exploitation on São Nicolau is apparently negligible (if any) as the colonies there were completely inaccessible without modern climbing equipment and the local people appeared to be largely uninterested in the birds as a source of food.

Feral cats were seen in the vicinity of many areas where Fea's Petrels breed and evidence of cat predation on three adults was found in one of the valleys on Fogo. Cats are efficient predators of seabirds, and their introduction to several other islands around the world has been associated with declines or extirpation of populations of gadfly petrels (Moors & Atkinson 1984). Petrel population trends are particularly sensitive to small increases in adult mortality (Simons 1984) and so even low predation rates by cats or humans can lead to rapid population declines.

The breeding sites of Fea's Petrel on São Nicolau and most of those on Santo Antão are now confined to cavities in precipitous cliffs that are inaccessible to humans. Similarly, Black-capped Petrels in Haiti are now confined to inaccessible cliffs because of human exploitation and predation (Wingate 1964). Cats have been recorded preying on *P. madeira* in the mountainous interior of Madeira (Zino 1992) where the terrain is as steep as that in São Nicolau and Santo Antão. However, the birds on Madeira breed at higher density in burrows on vegetated ledges, and so are more prone to cat predation

than those on São Nicolau and Santo Antão, which nest at lower densities in cliff-face cavities. Such colonies are probably safe from human exploitation and high cat predation, although it is possible that rats could gain access to the colonies and cause breeding failures, as has been reported for *P. madeira* (Buckle & Zino 1989, Zino & Biscoito 1994). With continuing predation by humans and cats, the remaining populations at the easily accessible colonies on Santo Antão are likely to decline until extirpated. On Fogo, all the colonies in the valleys and outside the caldeira are easily accessible to both humans and cats so predation there could continue until the population becomes limited to the two cliff sites above the caldeira.

Cape Verde is one of the poorest countries in the world and conservation of birds, and biodiversity in general, is inevitably of low priority. In addition, educational attainment among the human population is low and there is little sense of responsibility for the natural environment. Any initiative to conserve the unique avifauna of the Cape Verde Islands (Hazevoet 1995), including Fea's Petrel, will have to come from the 'developed' world. With foreign aid, a National Park is being established at Chã das Caldeiras on Fogo; the conservation of Fea's Petrel will hopefully be incorporated into the park's agenda. Any conservation programme will need to include local education and seasonal, long-term cat and rat control in order to achieve increases in the petrel's population there.

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