

HABITAT USE BY SEYCHELLES SOOTY TERNS *Sterna fuscata* AND IMPLICATIONS FOR COLONY MANAGEMENT

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Abstract

The relationship between sooty tern *Sterna fuscata* nest densities and vegetation characteristics of the breeding colonies was investigated on four islands in the Seychelles. Nest densities were greatest in areas with a vegetation cover of 30–50%, and areas that provided these conditions were generally dominated by pourpier *Portulaca oleracea*. On Aride Island, sooty terns nested at low density under an enclosed tree canopy but on the other islands nests were generally in the open, among sparse vegetation. On Desnoeuvs Island, where eggs are harvested commercially for human consumption, sooty terns avoided nesting in dense areas of *epi bleu* *Stachytarpheta jamaicensis*, an introduced plant whose success on the island may be related to egg exploitation. Management of colony vegetation, especially the control of introduced aggressive species, and the encouragement of optimum conditions for nesting, could increase the numbers of nesting sooty terns and their reproductive output, helping to buffer them against adverse effects of human activity. Appropriate protection of sooty tern colonies can also benefit rarer and more vulnerable seabirds and turtles that share nesting islands. © 1997 Elsevier Science Ltd

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INTRODUCTION

Sooty terns *Sterna fuscata* are among the world's most numerous oceanic birds but have suffered reductions in breeding numbers and colony extinctions throughout their range in the tropics. Factors involved in these declines include human exploitation, mainly of their eggs (Storr *et al.*, 1986), and habitat loss. The latter stems largely from the replacement of indigenous

vegetation on breeding islands with cultivations (de Korte, 1984), especially of coconuts *Cocos nucifera* (Feare, 1984).

Sooty terns nest typically in large colonies on islands, each pair making a scrape on the ground for the single egg. Sandy and coral substrates are commonly selected, especially where some low vegetation is present (Cramp, 1985). They also nest on the ground on rocky islands, usually in open areas of rock, grasses or sedges or other vegetation, and exceptionally (e.g. Aride Island, Seychelles) on the floor of woodland (this paper).

While it has been recognised that some habitats support higher nest densities than others (Ashmole, 1963; Feare, 1976a; Feare, 1979; Burger & Gochfeld, 1986; Haynes, 1987; Saliva & Burger, 1989), the densities supported by different habitats have rarely been assessed (Burger & Gochfeld, 1986). Identification of the habitats that support the highest densities of sooty terns can aid management of colonies in order to maximise production, either as part of sustainable exploitation programmes (Feare, 1976b), or in order to conserve sooty terns on islands where their numbers have been depleted by habitat loss or opportunist and unregulated collection of their eggs (Haynes, 1987).

In the Seychelles, sooty tern eggs are exploited commercially (Ridley & Percy, 1958; Feare, 1976b) but on some islands illegal collection of eggs also occurs. Poaching is wasteful and unregulated and is unlikely to be sustainable. On any visit to a colony by poachers, many eggs already present are destroyed in an attempt to ensure that all eggs collected subsequently are fresh. Adult sooty terns may also be taken for consumption, sometimes in thousands, together with eggs, chicks and adults of other seabird species, again with little likelihood of sustainability. In the Seychelles, these other species include masked and brown boobies *Sula dactylatra* and *S. leucogaster*, whose populations have declined throughout the area (Feare, 1978), and the roseate tern *Sterna dougallii*, whose numbers have declined world-wide (Gochfeld, 1983) and whose eggs are collected along with those of sooty terns (Ridley &

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Percy, 1958). In addition, visits to sooty tern colonies by poachers also present opportunities for them to take green turtles *Chelonia mydas*, which are globally threatened.

Commercial exploitation of eggs, on the other hand, presents three benefits in terms of conservation: (1) it satisfies a demand by local people for a much sought-after delicacy that cannot be satisfied by the provision of imported or locally farmed resources, and thus places a value on this natural resource and on the islands from which it comes, (2) well-organised and monitored commercial exploitation ensures that exploited colonies are not subject to poaching and (3) the protection of islands for commercial exploitation helps to protect other components of the island's fauna and flora.

The objective of this study, which is part of a wider investigation aimed at ensuring the sustainability of the annual egg harvest, is to identify those habitats that support the highest densities of sooty tern nests in order to provide guidelines on the kinds of habitat that should be encouraged to maximise colony size on those islands that still have sooty tern colonies.

METHODS

Study sites

Assessments of nest densities in relation to habitat were made on four islands: Bird Island, a privately owned 70 ha flat sand cay, operated as a quiet tourist centre and nature reserve; Aride Island, a 73.2 ha Royal Society for Nature Conservation nature reserve which is a well-wooded granitic island rising to 151 m, from which eggs are not exploited commercially, although the island is subject to periodic illegal poaching; Recif Island, a 6 ha government-owned granitic island of which about 3.7 ha is used by sooty terns in an area dominated by sedges, and which is subject to frequent poaching for eggs, chicks and adults of all seabirds that breed there; and Desnoeuvs Island, a 35 ha flat, raised reef island at the south of the Amirantes group, owned by the government but leased to the Island Development Corporation (IDC); it is here that the egg industry is based. On each island, habitats used by sooty terns were defined in relation to their vegetation and categorised by the dominant plant or plants.

ESTIMATION OF NEST DENSITIES

Nest densities were estimated on Bird Island and Aride in 1994 and 1995, on Recif in 1994 and on Desnoeuvs in 1995. All estimates were made in late June-early July when adult sooty terns were incubating.

On Bird, Recif and Desnoeuvs islands, nest densities in each habitat type were estimated by counting the number of nests in twenty 1 m² quadrats. The location of each quadrat to be sampled was determined

randomly within a habitat by throwing a lightweight paper ball, which did not damage eggs or birds, and centering the quadrat on the ball. Percentage vegetation cover was estimated for each quadrat and the average height of vegetation was estimated by eye.

On Aride, nest densities were determined from six 12.5 m wide transects designed to estimate the populations of all seabirds on the island as part of a monitoring programme for the Royal Society for Nature Conservation. Each transect was divided into 25 m blocks and each block was allocated to one of three habitat types:

(1) hill woodland—most blocks were dominated by mapou *Pisonia grandis*, 4–20 m high, and sooty terns nested on the ground beneath the trees; other trees that dominated some blocks were takamaka *Calophyllum inophyllum*, lafouche grand feuille *Ficus nautarum*, lafouche rouge *Ficus reflexa*, bois citron *Rothmannia annae* and bois de lait *Euphorbia pyrifolia*, whose canopy heights were similar to *P. grandis*;

(2) glade—clearings within hill woodland with scattered trees, mainly *R. annae*, and often with a dense ground cover, especially of mange tout *Asystasia* sp.;

(3) rock—granite outcrop with some low vegetation, especially pourpier *Portulaca oleracea*, growing wherever soil accumulated in cracks and hollows in the rock, together with scattered *E. pyrifolia* bushes.

Mean nest densities were calculated for each of these habitats by counting all nests in the 25 × 12.5 m blocks (312.5 m²). In 1994, % canopy cover and % ground cover of vegetation were estimated to the nearest 5% in the hill woodland and glade habitats. Where blocks were unoccupied in both years, these blocks were omitted from the analysis since they may be unsuitable for sooty terns.

Habitat availability

The availability of habitats used by sooty terns was estimated for Desnoeuvs island. About half of this island is designated a strict reserve, from which no eggs are collected. From the other part of the island, eggs are collected daily in a systematic way throughout the laying season (usually late May to early July) as long as it is commercially worthwhile to do so. Before the 1995 breeding season fibreglass “flexicanes” (Frontline Extrusions Ltd., Grimsby, UK) were erected as permanent markers of a 50 × 50 m grid in the reserve. These were used to map the distribution of the dominant vegetation types and of breeding sooty terns in each 50 × 50 m square. In the exploited part of the island, wooden marker posts had been erected on a similar grid some years previously and about half of the posts remained during the 1995 breeding season. These posts were used to map the dominant vegetation types in the exploited part of the island, but missing posts resulted in less accurate mapping than was possible in the reserve. The vegetation maps and nest density data (Table 1) were used to construct a map of the reserve showing the

distribution of sooty terns in three categories of nest density: high (>3 nests/m²), low (≤ 3 nests/m²) and zero. A similar map was produced of the exploited area, showing the potential of this part to support these nest density categories in the absence of egg harvesting.

RESULTS

The vegetation types identified on Bird, Desnoeuvs and Recif Islands are given in Table 1, together with the nest densities found in them and the % cover of vegetation. On Bird Island in 1994 and 1995 and Desnoeuvs Island there were significant variations in nest density between habitats (ANOVA, Bird I. 1994, $F_{6,133} = 42.14$, $p < 0.0001$; Bird I. 1995, $F_{11,228} = 48.99$, $p < 0.0001$; Desnoeuvs I., $F_{12,246} = 51.22$, $p < 0.0001$). Habitats dominated by pourpier supported significantly higher nest densities than all other habitats (Tukey HSD tests, $p < 0.05$), while habitats dominated by plant species that provided dense ground cover, e.g. patate caivin *Boerhavia repens*, pagote *Tribulus cistoides* and verveine *Lippia nodiflora*, all creepers which formed mats providing 100% ground cover in many quadrats, supported significantly lower nest densities than all other habitats ($p < 0.05$). Habitats that were dominated by pourpier were intermixed with bare ground and also sometimes with grass or sparse epi bleu *Stachytarpheta jamaicensis*, and on Bird Island in 1995, an area dominated by 20 cm tall grass, but interspersed with pourpier and bare ground, supported a nest density that was not significantly different from those of pourpier-dominated habitats on that island. On Desnoeuvs, epi bleu grew very densely over much of the exploited part of the island and dense swards were devoid of sooty terns. Around the edges of these dense patches, and where the epi bleu was intermixed with other plant species, birds did nest, but generally at comparatively low density unless the other plant species was pourpier. Herbe bourique grew in dense patches on Desnoeuvs and sooty terns only nested around the edges, while on Recif, the entire hill part of the island, where sooty terns nested, was dominated by a patchwork of this sedge and bare ground. This habitat supported over 4 nests/m² in the absence of poaching (Table 1).

Table 2. Number of sooty tern nests (± 1 s.e.) in 25×12.5 m (312.5m^2) blocks along line transects in three habitats on Aride Island, Seychelles in 1994 and 1995. Equivalent nest densities per m² are given in parentheses for comparison with Table 1

Habitat	No of blocks	1994	1995
Hill woodland	29	50.7 \pm 10.3 (0.16)	47.5 \pm 10.6 (0.15)
Glade 1	2	5.0 \pm 5.1 (0.02)	316.0 \pm 123.2 (1.03)
Glade 2	6	537.1 \pm 137.9 (1.72)	0.0 \pm 0.0
Rock	2	335.5 \pm 76.3 (1.07)	555.5 \pm 17.6 (1.78)

The most extensive habitat on Aride Island is hill woodland. This supported low densities of sooty terns in both years (Table 2), with 50 nests/block, equating to 0.16 nests/m². Nest densities were higher on open rock (equating to 1.07 and 1.78 nests/m² in 1994 and 1995 respectively), while densities in glade habitats varied between years, with a maximum of 1.72 nests/m² in glade 2 in 1994.

On Bird and Desnoeuvs the relationship between nest density and % plant cover is curvilinear (best fit obtained with a quadratic function), with maximum nest densities occurring in areas of 30–50% cover (Fig. 1). The shape of the curve did not differ between islands ($F_{2,18} = 2.54$, $p > 0.05$) but the position of the curve differed ($F_{1,20} = 6.08$, $p < 0.05$), being 1.3 ± 0.46 eggs higher on Bird Island than on Desnoeuvs. On Bird Island, there was no difference in the shape ($F_{2,11} = 0.75$, $p > 0.05$) or position ($F_{1,13} = 0.00$) of the curve between years. Multiple regression showed that vegetation height did not contribute significantly to the variation in egg density ($F_{1,25} = 0.53$, $p > 0.1$). The relationships between nest density and % vegetation cover were confirmed on Bird Island by differences within some of the habitats between years. For example, a reduction in % ground cover in grass/pourpier between 1994 and 1995 ($t_{38} = 4.62$, $p < 0.001$) was associated with an increase in nest density ($t_{38} = 4.69$, $p < 0.001$). Similarly, an increase in % ground cover of patate caivin/grass in 1995 compared with 1994 ($t_{38} = 6.59$, $p < 0.001$) was associated with a reduction in nest density in 1995 ($t_{38} = 2.85$, $p = 0.007$). In both of these instances, increase in nest density was accompanied by a change in % ground

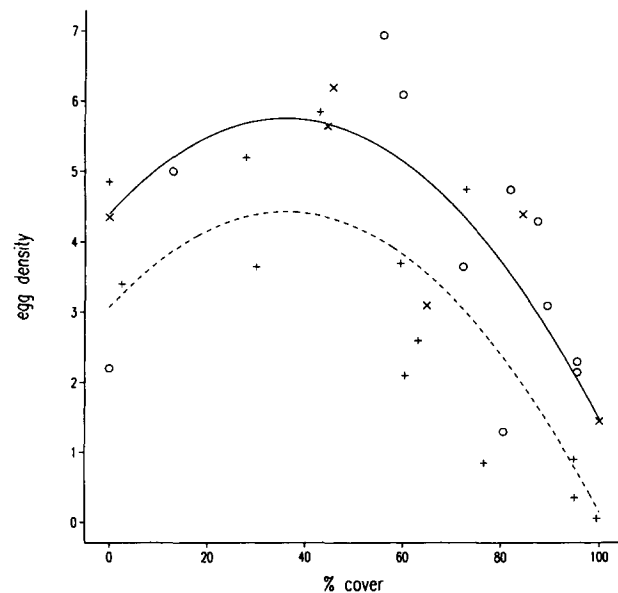


Fig. 1. The relationship between nest density (no. of eggs/m²) and % cover of ground vegetation on Bird Island in 1994 and 1995 (solid line) and on Desnoeuvs in 1995 (dashed line). Formulae for the fitted quadratic curves are: Bird Island 1994 and 1995 data combined nest density = $4.40 + 0.0755\text{cover} - 0.00105\text{cover}^2$; Desnoeuvs 1995 nest density = $3.07 + 0.0755\text{cover} - 0.00105\text{cover}^2$

cover of vegetation in the direction predicted by the model in Fig. 1 (Table 1). However, in pourpier/bare ground, an increase in % vegetation cover ($t_{38}=3.25$, $p=0.002$) was associated with an increase in nest density between years ($t_{38}=3.68$, $p=0.001$), although this parameter was in the upper part of the curve in Fig. 1 in both years. The difference in nest density between years on bare sand (Table 1; $t_{38}=6.07$, $p<0.001$) indicated that variations in nest density could occur in the absence of changes in vegetation cover.

The inter-year differences in the glade habitats on Aride (Table 2) were also related to ground vegetation cover. For example glade 2 in 1995 was carpeted with dense tangled mange tout, 30 cm high, which prevented sooty terns from nesting there, while in 1994 this species was absent and nesting terns colonised the area.

On Bird Island, the vegetation in all habitats except pissat de chine *Cleome viscosa* was < 20 cm tall. Pissat de chine, however, formed a canopy at 0.5–0.75 m and although this canopy provided an average 87.5% cover, the ground beneath the canopy was largely unvegetated and sooty terns nested at relatively high density (Table 1). On Desnoeuvs, most vegetation was similarly < 20 cm tall but two common species were taller and, in dense stands of both, nest density was low: herbe bourrique grew to 0.7–1.0 m tall and supported a nest density averaging 0.9 nests/m², while epi bleu, which grew as an impenetrable scrub 0.5–0.75 m high, almost totally excluded sooty terns.

In hill woodland on Aride Island, sooty terns nested beneath the 4–20 m tree canopy. Neither % ground cover nor % canopy cover (which were inversely correlated (Pearson $r_{28}=-0.46$, $p=0.012$)) were significant when entered in a multiple regression with log transformed nest number as the dependent variable ($p>0.1$). Most nests were in areas where the canopy cover exceeded 80% (Fig. 2).

On Desnoeuvs Island, most of the reserve was occupied by sooty terns (Fig. 3), with only small areas of

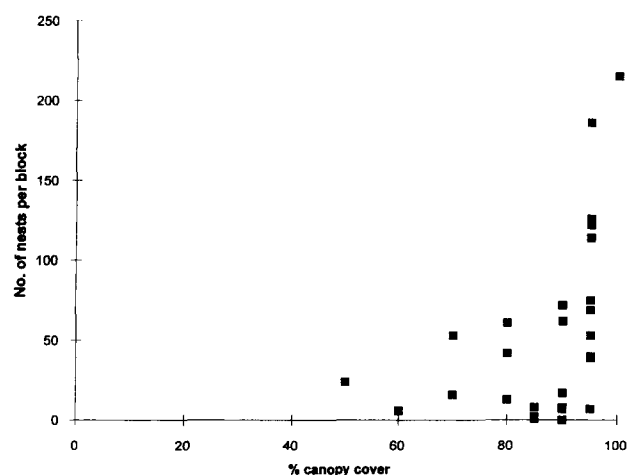


Fig. 2. The relationship between nest density (number of nests in 25 × 12.5 m blocks) and % tree canopy cover in hill woodland on Aride Island.

herbe bourrique and epi bleu which excluded birds. In the exploited part of the island, on the other hand, suitable habitat was more patchily distributed and a large area, estimated from the vegetation mapping at c. 30%, was rendered unavailable by dense stands of epi bleu.

DISCUSSION

Habitat use

Seychelles sooty terns nest in a variety of habitats, ranging from open areas, generally with some low vegetation, to the ground beneath a closed canopy under bushes and woodland. Nest densities were highest in open areas, where they were related to the ground cover of vegetation. The highest densities were recorded in areas where pourpier dominated the flora. Pourpier grows as individual plants, ≤15 cm tall, between which bare ground usually predominates; sooty terns make their scrapes in this bare ground. Where mats of pagote and patate caivin are dense, the birds are unable to make scrapes and lay their eggs on top of the vegetation. While pourpier appeared to provide an ideal combination of vegetation cover and bare ground, other factors may contribute to the birds' preference for this vegetation. The vegetation structure of a breeding colony varies during a breeding season, under the influence of weather and of the birds themselves, which deposit droppings and sea water and also trample the vegetation, especially around the nests. The combination of these factors leads to a gradual degradation of the vegetation (Feare, 1979). Pourpier is especially susceptible to this, whereas other plants that comprise the ground flora on Bird Island and Desnoeuvs, such as patate caivin, pagote and grasses, die back more slowly

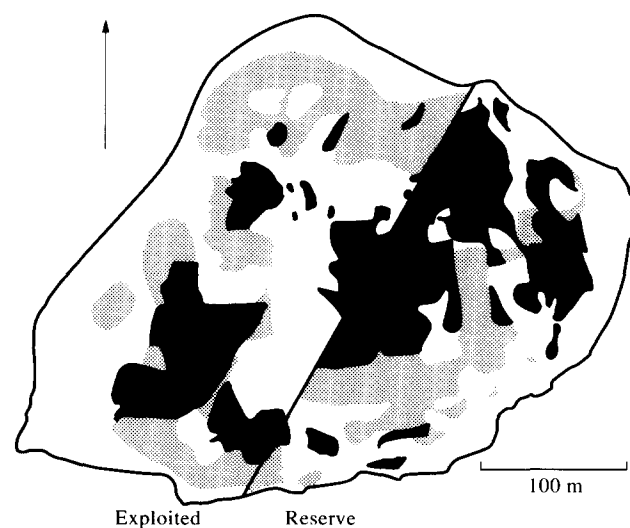


Fig. 3. The distribution of breeding Sooty Terns in the reserve on Desnoeuvs Island: black = > 3 nests / m², stippled = < 3 nests / m², unshaded = no nests. In the exploited part of the island the shading indicates the densities that might be expected from the vegetation structure within that part of the island.

and leave dead stems and runners, together with some living material, over the ground surface within the colonies.

During egg-laying and incubation, physical features of the habitat, including vegetation, may be important for nest-site recognition by the adults (Ashmole, 1963). After hatching, vegetation provides shade for young chicks when adults are absent (Howell & Bartholomew, 1962) but when chicks become older and wander further from the nest, especially when disturbed, ability to return rapidly to the nest site becomes important to reduce attacks from neighbouring adults (Ashmole, 1963; Feare, 1976a). The presence of ground vegetation impedes movement and thus slows return to the nest site, thereby increasing the risk of injury to the chicks. In selecting a nest site, sooty terns must trade off the requirement for site recognition and shade early during the breeding season against the later need for a habitat that facilitates chick movement. The rapid die-off of pourpier appears to provide the best conditions available in the colonies studied here and, on Bird Island, sooty terns nesting in central locations dominated by pourpier were more successful in producing fledglings than birds that nested in other parts of the colony (Feare, 1976a).

The ability of sooty terns to modify vegetation by trampling, and by sea water and faecal deposition, is related to the time during which birds are active in the colony. When terns are undisturbed throughout the season the colony is occupied for about 5 months and pourpier-dominated areas often become practically bare by the time the birds leave (Feare, 1979). Where eggs are repeatedly removed through harvesting the breeding colony is deserted from the end of the laying season, adults spending only about two months in the colony. Where eggs are harvested, therefore, the influence of birds on vegetation is diminished and this allows it to regenerate. The dense stands of epi bleu in the exploited part of Desnoeuvs Island may have become established through the absence of bird activity in this part of the colony over successive seasons and annually repeated egg exploitation may, in the absence of appropriate management, lead to an impoverishment of habitats for sooty terns (see below). On Bird Island, desertion of a part of the colony caused by a severe infestation of ticks in 1973 led to a dense growth of bois d'amande *Suriana maritima* which subsequently excluded birds from this part of the colony (Feare & Gill, 1997).

On Aride Island, nest densities were lower than on the other islands studied here (Table 2) but similar to those recorded by Saliva & Burger (1989) in habitats with taller vegetation (*c.* 0.7 m) and an enclosed canopy above the nests. Furthermore, sooty terns on this island were much less approachable than on the other islands. In hill woodland, the most extensive habitat available on Aride, dense canopy cover was associated with low ground cover, both of which characteristics promoted low nest densities on Bird and Desnoeuvs Islands.

Although there was no relationship between nest density and either % ground cover or % canopy cover on Aride Island, the highest nest densities in this habitat occurred under the most enclosed canopies (Fig. 2), despite the difficulties this presented to the birds in flying to and from their nests. The resulting difficulty of escape on disturbance may explain the extreme wariness of sooty terns on Aride Island.

Implications for management

The sooty tern colonies studied here were not uniform in vegetation type and nest densities varied according to vegetation. This raises the possibility of managing vegetation in order to increase the availability of habitats that support high densities of nesting terns, in the expectation that this will increase the number of nesting terns within a colony. That such management can be effective was demonstrated in the late 1960s and early 1970s on Bird Island, when clearance of part of the coconut plantation led to an increase in the colony from 18,000 to 395,000 pairs in 6 years (Feare, 1976a). Subsequent management on Bird Island has involved an annual burn of the colony area to prevent the growth of woody plants, together with the cutting of bushes such as bois tabac *Tournefortia argentea*, veloutier *Scaevola taccada* and bois d'amande *Suriana maritima* that readily establish within the colony.

The main constraint on the production of eggs in the exploited part of Desnoeuvs Island is the extensive growth of epi bleu. This plant did not occur on Desnoeuvs island in 1900 but was present by 1955 (Ridley & Percy 1958). The time and method of its introduction are unknown, but in 1955 it was clearly much less widespread than during the present study, as Ridley and Percy (1958) found sooty terns to be nesting at high density over most of the island. As suggested above, the present excessive growth of epi bleu may be facilitated by the desertion of this part of the colony following the egg harvest, and the vegetation management that would have been accomplished by the activities of the birds should be replaced by management by man. The aim of this management should be to remove the existing dense stands of epi bleu and work towards their replacement with vegetation more sympathetic to sooty tern nesting, especially pourpier. The initial removal of the existing epi bleu will need to be followed by annual removal of epi bleu seedlings and the method and timing of this activity should be determined by experiment. Attempts should also be made to seed cleared areas with pourpier. Once the best form of management has been identified, this should be regarded as an integral part of the egg industry.

Other kinds of vegetation also limit nest density. Pagote is a perennial and spreads fan-like from a single tap root, and in the 1994 breeding season on Bird Island plants attained diameters > 10 m. In addition to supporting only low densities of terns (Table 1), pagote-dominated areas provided clear space in the centre of

the colony in which cattle egrets *Bubulcus ibis* could land. They used these areas as foci for the predation of eggs and chicks. Preliminary work on Bird Island following the 1994 breeding season suggests that the removal of pagote is practicable and effective in promoting increases in nest density. Plants were cleared by rolling up the mats, pulling out the tap roots and then burning. In a cleared area that was monitored, pourpier and grass became established and the density of nests increased to $6.10 \pm 0.22 / \text{m}^2$ in 1995 from $1.45 \pm 0.29 / \text{m}^2$ in 1994 when pagote was present (Pearson $t_{38} = 12.7$, $p < 0.001$).

On Aride Island, the plant that most inhibits sooty tern nesting in glades and woodland edge is mange tout *Asystasia* sp. The status of this plant in the Seychelles is unclear but Friedman (1994) considered that the aggressive weed form, as found on Aride, was probably introduced. The factors that affect the growth of this plant, which can reproduce both vegetatively and sexually (Robertson, 1989), appear complex and the amount of light penetrating the canopy and variations in rainfall lead to annual variations in the extent of its growth. The effects of its presence/absence (due to weather) in glade 2 are clear from Table 2. The effects of its removal or cutting immediately before the arrival of the birds were demonstrated in 1993 when an area where roseate terns had formerly nested was cleared of mange tout, to encourage these birds to return, was instead colonised by sooty terns. If sooty tern numbers on Aride are to be maximised, the management of mange tout may need to be regarded as an annual part of colony management. However, studies of the habitat requirements of roseate terns, and of possible competition for nesting areas between roseate and sooty terns, are needed to ensure that any habitat management undertaken is sympathetic to the rarer roseate terns.

While management of less-favoured vegetation would benefit sooty terns, the means by which management is achieved requires careful selection. Only physical means—pulling up plants, cutting, burning or a combination of these—should be considered as these are most likely to promote the desired vegetation types in breeding colonies. Chemical control should not be considered; it would be largely unselective and could remove desirable components like pourpier. In addition, chemical control might affect other components of the islands' ecosystems about which little is still known.

This study has suggested ways in which the management of vegetation in sooty tern colonies in the Seychelles can increase the density of nesting birds and thereby increase the size of breeding colonies that are otherwise restricted by space. Where sooty terns nest in dense colonies in other parts of the world, descriptions of nesting areas suggest that vegetational characteristics are similar, although the species of plants may differ (Cramp, 1985; Storr *et al.* 1986). Vegetation management, especially of introduced aggressive species, might thus be a useful tool on a wider scale in promoting

higher breeding productivity as a buffer against threats posed by human activities. Where consideration is given to the management of indigenous vegetation, the implications of this for the welfare of other taxa should first be investigated. Although common in most parts of their range, sooty terns are widely threatened by human activities. These include encroachment of their breeding areas by agricultural, urban and recreational developments and exploitation, especially unregulated harvesting of their eggs. Unregulated harvesting over the long term may, through reducing the activities of sooty terns within their colonies, lead to a degeneration of the habitat which will ultimately render it unsuitable for these birds. Unregulated harvesting is also frequently accompanied by the harvesting and disturbance of other species, some of which (e.g. roseate terns, boobies and turtles) are globally threatened. Where indigenous peoples have a need (nutritional or sociological) for sooty tern eggs, the satisfaction of this need could be put to conservation advantage by implementing a controlled harvest strategy with associated monitoring and management. Such a strategy would ensure that the sooty tern egg harvest were sustainable, that the habitat within breeding colonies remained optimal for the birds, and that other components of the islands' flora and fauna received protection which would otherwise be difficult to police. The present findings also demonstrate the value of understanding the habitat preferences of other ground-nesting seabirds, for habitat management could prove an important component in the management of rarer seabirds (Ramos & del Nevo, 1995). Where there may be competition for nesting space between rarer and commoner species (Spendlow, 1982), it is especially important that habitat requirements are sufficiently understood that the former are not disadvantaged by any human-induced habitat changes.

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