

The breeding biology of the Critically Endangered Seychelles Scops-owl *Otus insularis*: consequences for conservation and management

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Summary

The endemic Seychelles Scops-owl *Otus insularis* is a Critically Endangered restricted-range species currently recorded only from the montane forest of Mahé, the largest (152 km²) and highest (903 m) island in the granitic Seychelles. Limited research has been conducted on the species and, in particular, details of its breeding biology are poorly known. Behavioural observations were made on 12 pairs by the systematic monthly use of playback of conspecific calls, in conjunction with frequent non-playback territory visits from April 1999 to May 2001. A total of eight nests, including the first nest record, were found on three territories. All were in tree cavities (7–25 m high) and contained either a single egg or chick. This was consistent with additional observations of solitary fledglings ($n = 11$, from eight territories). Incubation lasted 3–4 weeks and the fledging period was 4–6 weeks (data from two nests). The timing of copulations, in conjunction with the detection of nests and fledglings, suggests that the scops-owl can breed throughout the year with peaks in nesting occurring around May and October. Sex roles during breeding were similar to those of other Strigidae owls: incubation was performed by the female; males courtship-fed the female prior to and during incubation, and the female and chick for the first 2 weeks post-hatching; and both parents fed older chicks and fledglings. Fledglings remained on territory for at least 3 months. Breeding success of study pairs was low: two of eight nests were successful and 11 fledglings (recorded from eight of 12 study territories) were observed in a 26-month period, equivalent to *c.* 0.5 fledglings per territory per year. Evidence suggests that alien predators may have been a factor limiting breeding success. We discuss the conservation implications of our findings.

Introduction

Seychelles Scops-owl *Otus insularis* (Tristram 1880) is currently known only from the upland mist forests on the 152 km² island of Mahé in the Seychelles archipelago, western Indian Ocean (Collar and Stuart 1985). It was thought extinct in the early twentieth century (e.g. Greenway 1958), prior to its rediscovery in 1960 (Loustau-Lalanne 1961), and is currently classified as Critically Endangered on the basis of its small population (minimum estimate of 80–90 pairs; Rocamora 1997, Watson 2000) and restricted range (BirdLife International 2000).

Difficulties in studying the scops-owl, due to its nocturnal habits and the mountainous terrain, have resulted in a lack of baseline ecological data. It is the

most poorly known of Seychelles' endemic landbirds and it was only recently that the first nest was found (Fanchette *et al.* 2000). The limited data available on breeding behaviour from research conducted in the 1970s, based on the timing of copulations and detection of fledglings ($n = 4$), led to the supposition that individuals were able to nest throughout the year, with there possibly being two distinct peaks in breeding activities, in April and October (Watson 1980, 2000).

In this paper we present novel data on the breeding biology of Seychelles Scops-owl collected over a 26-month period from April 1999 to May 2001, based on systematic monthly observations of colour-ringed individuals occupying known ranges. We quantify the timing of breeding, sex roles during breeding, and in light of our findings discuss the implications for the conservation and management of this species.

Methods

Study species

Seychelles Scops-owl is a small, cryptically coloured brown owl (*c.* 21cm in length; Sinclair and Langrand 1998), which has small ear-tufts, unfeathered tarsi and feet, and produces a characteristic repeated "waugh" territorial call (Tristram 1880; see also Watson 1980, 2000, Rocamora 1997). The species normally approaches and produces an auditory response to the playback of conspecific calls (Watson 1980, 2000, Rocamora 1997).

Study area

The study was conducted along two transects within the known distribution of the scops-owl (Casse Dent–Mare aux Cochons–Danzil [T₁] and Trois Frères–Le Niol [T₂]) in the Morne Seychellois National Park, Mahé, Seychelles (*c.* 4° S, 55° E) from April 1999 to May 2001. Total transect length was 8.4 km and comprised 43 points *c.* 200 m apart, ranging in altitude from 140 to 710 m asl (Figure 1). For more details see Currie *et al.* (2002a).

In Seychelles, temperature and humidity vary little through the year, but rainfall is seasonal, with peak rainfall in December/January, during the north-west monsoon (which lasts approximately from November to April). June–August are the driest months, dominated by the south-east monsoon (Walsh 1984).

Playback

Playback of male calls was conducted for 10 min at all fixed points along both transects once a month (April 1999 to May 2001) at 18h00–24h00 local time. For more details see Currie *et al.* (2002a). Colour-ringing of individuals facilitated the identification of 12 territories along the transects. Eight of the same territories (all on one transect) were also visited once a month from April 1999 to April 2000 to record male vocalizations: calls were induced in response to playback conducted at one point within each territory for a maximum of 10 min. Playback of duet calls was conducted on all 12 territories (one point per territory) once a month from June 2000 to November 2000, also for a maximum of 10 minutes.

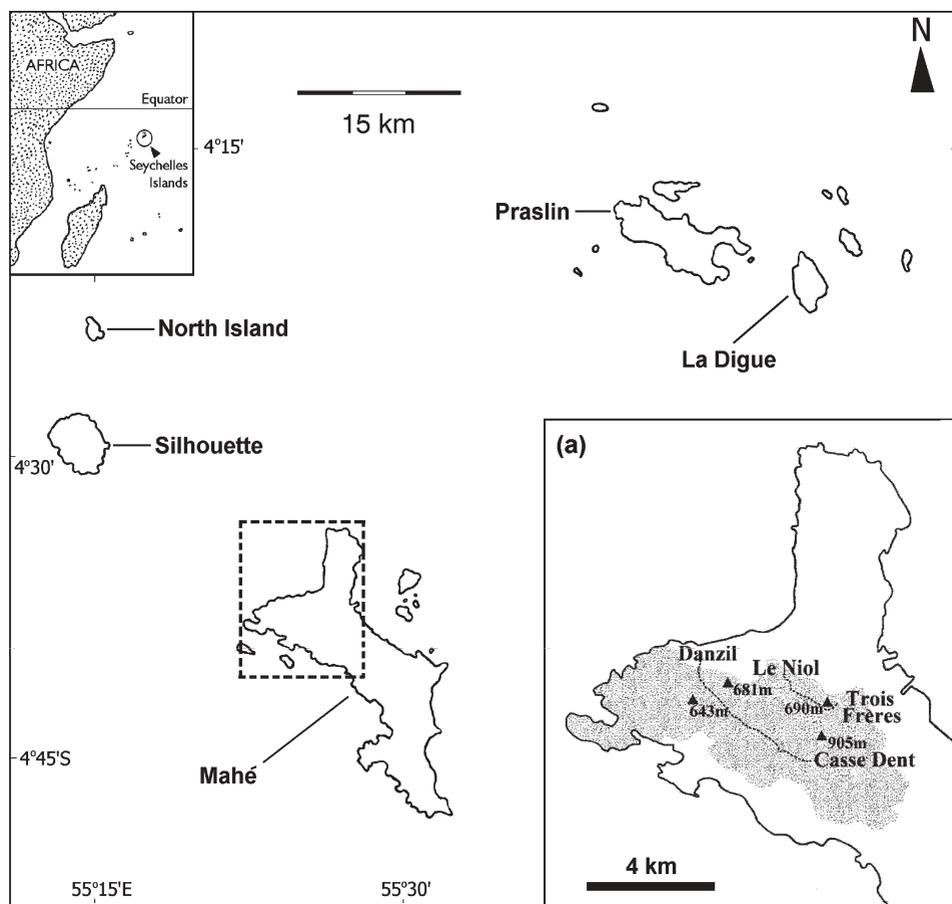


Figure 1. Map of inner Seychelles. Inset (a) shows the marked area on Mahé, and highlights the Morne Seychellois National Park (shaded area) and the two study transects: Casse Dent–Danzil (T1) and Trois Frères–Le Niol (T2).

During these systematic monthly visits to the 12 study territories, we noted when pairs were heard or observed to copulate: copulations are characterized by a high-pitched trill/whistle (Watson 1980, 2000, Rocamora 1997), and were recognized by observers in this study from July 1999 onwards. Multiple copulations were recorded during some territory visits. However, since territories comprised several fixed points along transects (average territory length was 2.92 fixed points, range 1–6; Currie 2002a) and multiple visits were made to some territories within a month, we noted the number of study pairs heard copulating per month, as multiple copulations from the same territory were not independent. We defined copulations as: (i) systematic copulations, i.e. copulations detected during systematic monthly visits to territories (using playback), and (ii) total copulations, which included copulations recorded during non-systematic territory visits. We also noted the presence of fledglings, which made a distinctive “whsst” call. Recently fledged individuals are also characterized by distinctive

chest barring and a fluffy appearance (Watson 1980, 2000). We include data from the first nest record (Fanchette *et al.* 2000) in this paper, as the nest was found during the study. Weather data were provided by Seychelles Meteorological Services.

Filming at nests

Provisioning was filmed at two nests. At each nest a tripod and waterproof camera-hood were set up *c.* 2 m from the entrance to the nest-cavity soon after hatching. The camera, a Sony Hi 8 mm video camera with night-view zero lux IR facility and a 12 hr battery utilizing the slow-play facility, was placed under the hood during filming. When filming, cassettes were changed every 3 hrs. A male was colour-ringed at one nest, while at the other nest neither parent was colour-ringed and individuals were recognized on the basis of behaviour and call.

Results

Copulations

Copulation calls were heard on territories only after the pair had been duetting, but only those duets where the intensity of male and female calls rapidly increased over time and in which the basic “waugh” call typically became very distorted. These duets were normally associated with a range of distinct vocalizations including frog-like and duck-like calls (“quacking”), and gurgling calls (“arguing”).

There were 25 instances of pairs copulating during the playback of male calls (three during recording of male vocalizations), three instances of copulations being heard during the playback of the duet tape, and 15 instances of pairs copulating spontaneously during non-systematic monthly territory visits.

Copulation calls normally lasted *c.* 2 seconds and occurred in the mid- to high canopy. Calls were recorded throughout most of the year, but were most frequent March–September and generally coincided with peaks in territoriality occurring around April and October (defined by the proportion of fixed points within territories where males and pairs were detected; Figure 2). Copulations were less frequently recorded during the wettest months (November–January). Calls were heard up to 3 months prior to laying (data from three nests), and on some territories coincided with detection of fledglings at a later date (Table 1).

Nests

The first nest of Seychelles Scops-owl was located in a tree-cavity and contained a single egg (Fanchette *et al.* 2000). All nests subsequently found also utilized cavities in trees and contained either one egg or chick ($n = 7$, data from three territories; Table 2). Mean egg size dimensions (mm; length \times breadth) \pm SE were $34.73 \pm 0.49 \times 29.3 \pm 0.58$ ($n = 4$, from two territories).

Nest-cavities were found in two tree species – Bwa Rouz *Dillenia ferruginea* and Sangdragon *Pterocarpus indicus* – and were narrow (hand-sized) holes, and

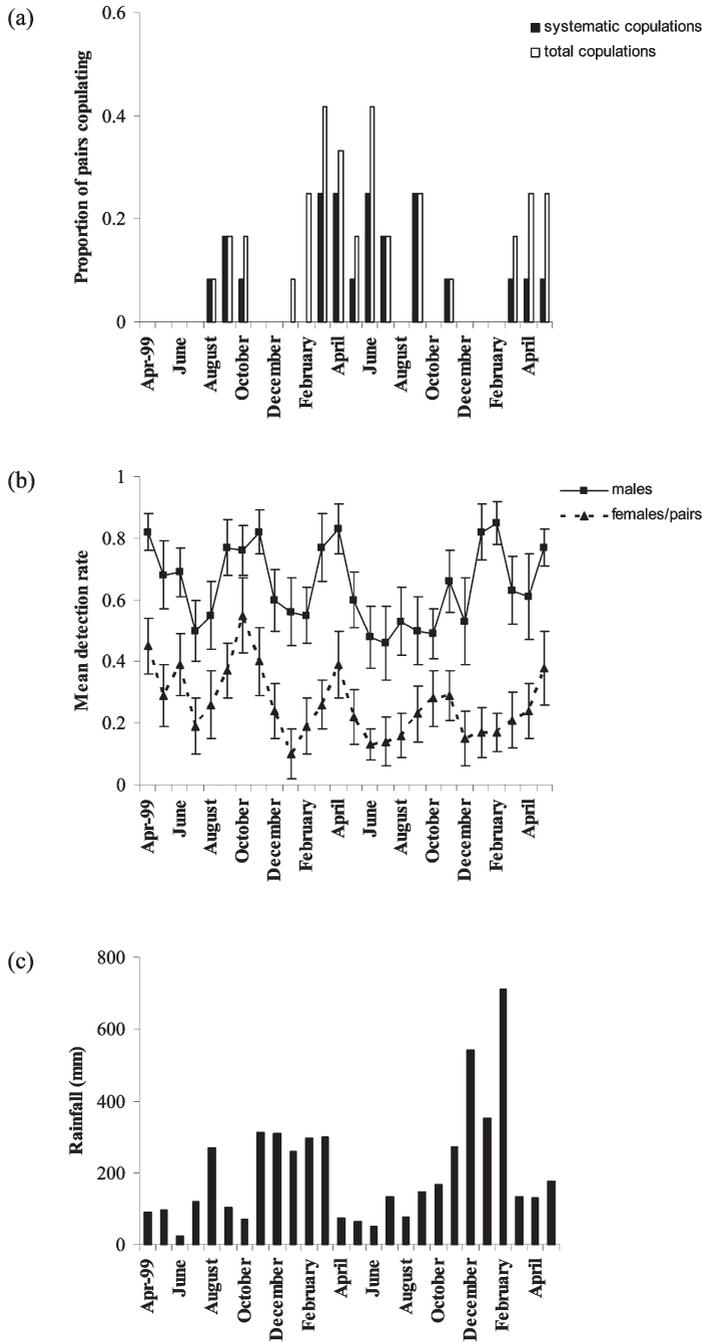


Figure 2. (a) Proportion of study pairs of Seychelles Scops-owl recorded copulating by month June 1999 to May 2001 (no data April–June 1999). (b) Mean proportion of fixed points within territories (\pm SE) at which males and females/pairs were detected (from Currie *et al.* 2002a). (c) Monthly rainfall for the study period (April 1999 to May 2001; rainfall data were from Morne Blanc Tea Factory c. 400 m asl, provided by Seychelles Meteorological Services).

Table 1. Timing of copulations (systematic and spontaneous) in Seychelles Scops-owl, and detection of nests and/or fledglings on study territories.

Territory	Copulations	Lay date	Notes
T ₁ ²⁸	–	May ^P	Recent fledgling August 1999
T ₂ ⁵	–	June ^P	Recent fledgling September 1999
T ₁ ¹⁴	September–October 1999	October ^P	Mature fledgling January 2000
T ₁ ⁴	February–April 2000	May	Nest failed
T ₁ ⁴	July 2000	October	Fledged 25 December 2000
T ₁ ²⁹	February 2000	March	Fledged 17 May 2000, flying 16 June 2000
T ₂ ⁹	April–June 2000	June ^P	Recent fledgling September 2000
T ₁ ⁶	September 2000	October ^P	Mature fledgling February 2000
T ₁ ²⁹	June 2000	July ^P	Mature fledgling November 2000
T ₁ ⁹	January 2001	January ^P	Recent fledgling March 2001
T ₁ ⁴	February–April 2001	April	Nest failed

–, no data.

Recent fledgling (c. 8–12 weeks old) — clumsy flier, barred plumage, characteristic “whsst” call.

Mature fledgling (c. 16–20 weeks old) — confident flier, adult-like appearance, but still using the “whsst” call.

Lay dates with the superscript *P* are predicted dates.

fissures or splits in the main trunk and thick peripheral branches. Nests were found throughout the year, but there appeared to be two peaks in laying around May and November, which coincided with peaks in copulations in the preceding months (Figure 3a and b).

Detection of fledglings

Eleven solitary fledglings were observed on eight of the focal territories (April 1999 to May 2001), consistent with the above observations of nests containing a single egg or chick. Five of the 11 fledglings had recently left the nest, and were characterized by their fluffy plumage, clumsy flight and “whsst” call. The other six fledglings were older individuals characterized by a more adult-like appearance, but still called using the “whsst” call. The detection of recent fledglings (February–October) loosely followed the distribution of copulations and nests, while mature fledglings were usually detected October–February (Figure 3).

Length of the breeding cycle

Monitoring of two nests indicated that incubation lasted c. 3–4 weeks, and the nestling period was c. 4–6 weeks. The 6-week period may have been a result of a deep vertical nest-cavity, which delayed fledging.

At both nests, the single fledgling left the cavity before being able to fly: both were observed perched 3–5 m above the nest-cavity several days after leaving the nest. One fledgling was not observed again after this time. The other fledgling was observed flying (albeit clumsily) on its natal territory accompanied by both parents 1 month after leaving the nest. These observations suggest a c. 2- to 3-month interval between laying and the detection of recent fledglings that are able to fly.

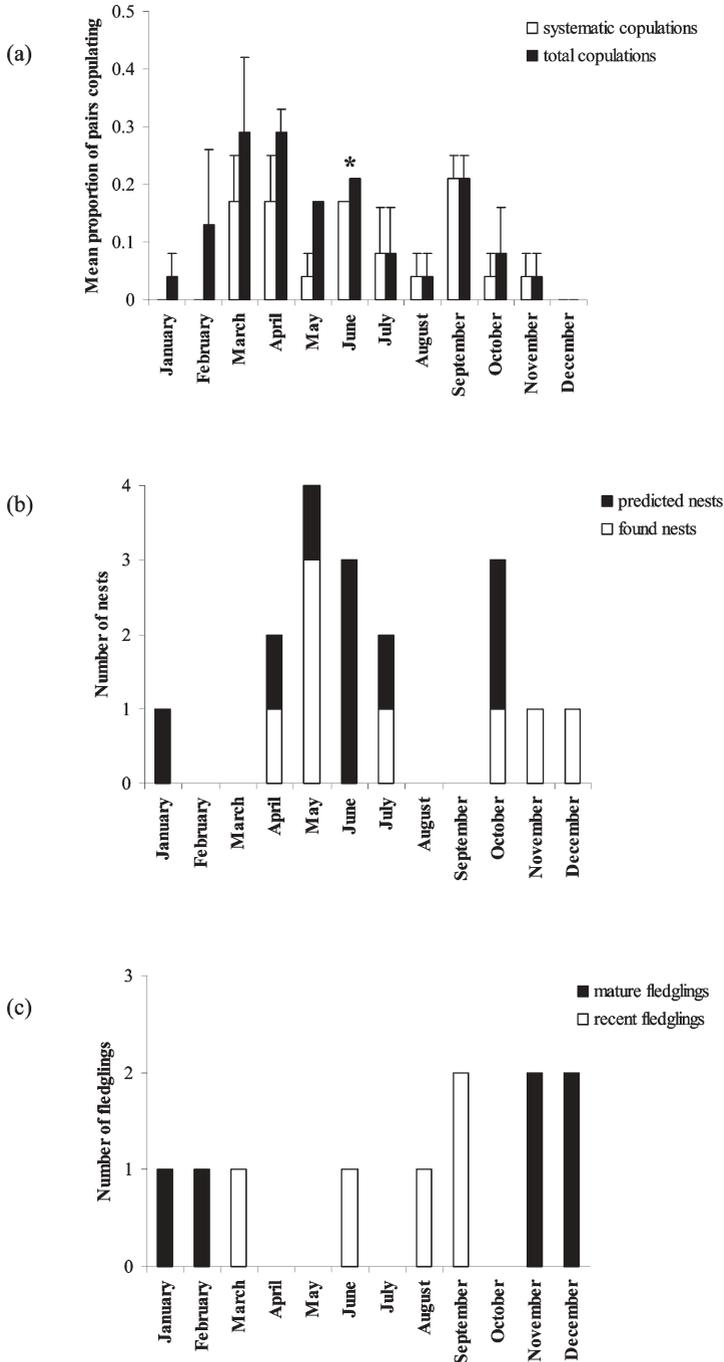


Figure 3. (a) Mean monthly proportion of pairs of Seychelles Scops-owl recorded copulating (\pm SE) June 1999 to May 2001 (*data for June from 1 year only). (b) Detection of nests (including predicted nests calculated from timing of copulations and/or detection of fledglings; see Table 2). (c) First detection of recent and mature fledglings (some fledglings were observed on territory for another 3 months).

Table 2. Details of Seychelles Scops-owl nests found between May 1999 and May 2001.

Nest	Date	Altitude (m)	Contents	Tree species	DBH (m)	Nest height (m)	Canopy height (m)
1 ⁹	19 May 1999	450	Egg	<i>Dillenia ferruginea</i>	50	7	15
2 ⁹	14 July 1999	450	Egg	<i>Dillenia ferruginea</i>	30	9	15
3 ⁹	23 Nov. 1999	450	Egg	<i>Dillenia ferruginea</i>	50	7	15
4 ⁹	9 Dec. 1999	450	Egg	<i>Dillenia ferruginea</i>	50	7	15
5 ²⁹	23 Apr. 2000	200	Chick	<i>Pterocarpus indicus</i>	110	16	30
6 ⁴	15 May 2000	420	Egg	<i>Pterocarpus indicus</i>	100	25	30
7 ⁴	15 Nov. 2000	420	Egg	<i>Pterocarpus indicus</i>	130	16	30
8 ⁴	15 May 2001	420	Egg	<i>Pterocarpus indicus</i>	100	7	30

DBH, diameter at breast height.

Nests with same superscript were on same territory; nests 1 and 4 were in the same cavity; nests 6 and 8 were in same tree; details of nest 1 from Fanchette *et al.* (2000).

Observations of recently fledged chicks from four territories showed that fledglings remained on their natal territories for at least 3–4 months, by which time individuals had taken on the appearance of an adult: fledglings were still observed begging and being fed by adults up to 3 months after leaving the nest. Mature fledglings were rarely observed with their parents, but could still be found on their natal territory. Very mature individuals were observed to respond to playback with an adult-like “waugh” call and were presumed to disperse soon after.

Based on these observations, a successful breeding attempt, i.e. laying to fledgling independence, was estimated to take *c.* 5–6 months. It was therefore possible for individuals to breed successfully twice in a 12-month period. There were two confirmed instance of pairs doing so: a successful nesting attempt during April 2000 (T1²⁹; see Table 2), fledging in May, was followed by the detection of a second fledgling on the same territory in November. Laying was estimated to have occurred in late July or early August, which was consistent with copulations having been heard in June. The first (colour-ringed) fledgling was still on the territory in October, which would mean that although “independent” it was still on-territory during both incubation and provisioning of the nestling. In the other instance, a successful breeding attempt in October was followed by another breeding attempt in April (T1⁴; see Table 1). Moreover, three other pairs were also heard to copulate regularly at 5- to 6-month intervals (March–April and August–September 1999–2001), although no fledglings from presumed successive breeding attempts were detected on these same territories.

Sex roles

Behavioural observations on four territories showed there was a period of at least 1 month prior to egg-laying of intense courtship feeding of the female by the male. During this time the female was frequently heard to utter a previously undescribed “squack” begging call. Members of the pairs were observed to remain in close proximity to each other during this time, and the male was observed to feed the pair female in response to her begging calls. In addition to

begging, the frequent interactions between the pair also involved allo-preening and numerous duets. The duets normally increased rapidly in intensity, some of which climaxed with the pair copulating. The frequency of (spontaneous) copulations increased prior to breeding: up to four a night were heard in the weeks immediately prior to laying.

The onset of incubation was characterized by a clear cessation in courtship behaviour and copulations, and the onset of females begging from a fixed area or point. Begging provided a reliable indicator of nest location. Females were heard to beg throughout the night; for example in an 11-hr period during the first week of incubation (19h03–06h02) an incubating female was heard to beg 18 times at and near the nest. Mean time interval between begs (min \pm SE) was 31.2 ± 6.1 . This intensity of begging was by no means atypical, although quantitative data at other nests were lacking. There was no evidence that males participated in incubation.

Video observations at the two successful nests showed that during the night females typically remained in the cavity with the chick for up to 2 weeks post-hatching. During this time females were only observed to leave the nest-cavity soon after dusk and then again once or twice during the night, and as a result the male did the majority of provisioning.

Two to three weeks after hatching the female's contribution to provisioning increased, and was reflected in the increased rate of provisioning: from 1.8 feeds per hr documented in the first week post-hatching to 2.4 feeds per hr by the fourth week. Some female provisioning may have been captured by the male and passed to the female off-camera. However, both sexes were also simultaneously observed to visit the nest-cavity with prey items from the second week onwards. During the day, females roosted in the nest-cavity with the chick for up to about 3 weeks after hatching.

Both parents were observed to feed the fledgling immediately after it had left the nest and for up to 3 months after leaving the nest. There was a suggestion that mature fledglings associated more with the male. Observations of a mature fledgling duetting with one of its parents and the presence of a fledgling on territory during a later breeding attempt (see above) indicated that fledglings remained and were tolerated on their natal territory for a considerable time.

Breeding success

The nesting success of study pairs was low. Of the eight nests found only two successfully fledged a chick. At least two nests, and probably a third, failed due to de-predation by a mammal, almost certainly Black Rat *Rattus rattus*. An additional three nests failed to hatch eggs and were abandoned. Eggs were collected c. 8 weeks after the nest had been found and their contents were analysed. One of the eggs was infertile or had suffered very early embryonic death: there were no obvious signs of embryonic development even though the female was observed to be incubating after the nest's discovery. Both other eggs were fertile: one was found to be cracked, while the other may have failed due to desertion caused by localized forestry activity in close proximity to the nest.

Similarly, there was a low rate of detecting fledglings despite their conspicuous "whsst" call. A third (4/12) of study pairs were definitely confirmed as producing fledglings between 1 April 1999 and 1 April 2000, while 58% (7/12) of

pairs were observed to have produced fledglings between 2 April 2000 and 2 April 2001. This was equivalent to *c.* 0.5 fledglings produced per study territory per year. No data were available on fledgling survival.

Discussion

This paper presents the first baseline quantitative data on the breeding biology of the Critically Endangered Seychelles Scops-owl. To the best of our knowledge it is also the first paper quantifying the breeding biology of any montane *Otus* species.

The first Seychelles Scops-owl nest was found during this study (Fanchette *et al.* 2000), almost 40 years after the rediscovery of the owl. Prior to finding the nest, the absence of nest observations, the owl's distinctive bare legs (unusual among *Otus* species and a characteristic of burrowing owls; del Hoyo *et al.* 1999) and observations of individuals close to the ground led to the supposition of subterranean nesting (Watson 2000). Evidence from this study suggests this is not the case and the species appears to be a tree-cavity nester, laying one egg.

Although a clutch size of one egg is unusual among owls (del Hoyo *et al.* 1999), small clutch sizes (one or two eggs) are a common trait among most Seychelles endemic landbirds (Watson 1978). In most other aspects of its breeding ecology Seychelles Scops-owl appears similar to other owls of the family Strigidae. Incubation and brooding of the young chick was done solely by the female; the male provisioned the female prior to and during incubation, and both the female and recently hatched chicks during the nestling period. Both parents provisioned older nestlings and fledglings. Apart from one instance when a female was apparently heard to both duet and copulate with two males in succession, all evidence indicates that Seychelles Scops-owl is socially monogamous.

Breeding seasonality

Many Seychelles endemic landbirds exhibit a peak in breeding during the wet season (e.g. Seychelles Kestrel *Falco araea*, Watson 1991a; Seychelles Black Paradise Flycatcher *Terpsiphone corvina*, Watson 1991b; Seychelles White-eye *Zosterops modestus*, Rocamora and François 2000; Seychelles Magpie-robin *Copsychus sechellarum*, McCulloch 1994). However, tropical owl species, which experience marked wet and dry seasons, usually breed in the dry season (or towards the end of it), with young being fledged in the wet season, presumably to experience the increased food availability that occurs during this time (del Hoyo *et al.* 1999).

Data were equivocal as to whether this species bred predominantly in the wet season: the finding of nests in conjunction with the timing of copulations and the detection of fledglings indicated that many owls bred either side of the wet season (in October and April). However, breeding occurred throughout most of the year, including much of the dry season, and consequently fledglings were detected towards the end of the dry and throughout the wet season. In this respect it seems similar to other *Otus* species, in breeding to coincide with presumed increased food availability (del Hoyo *et al.* 1999).

Based on the timing of copulations and detection of fledglings, Watson (1980, 2000) suggested two peaks in breeding: April and October. These are typically the months between the wet and dry seasons and are characterized by calm and fair weather. A high proportion of study pairs was recorded copulating in March–April, which corresponded with the subsequent detection of nests and fledglings several months later. April is generally also associated with a peak in territoriality (indicated by the high proportion of fixed points within study territories that individuals were detected at; Figure 2b, Currie *et al.* 2002a). The majority of individuals trapped during March and April also exhibited reproductive condition: males showed cloacal protrusions and females exhibited brood patches (Currie *et al.* 2002b). However, evidence for a second genuine peak in breeding activity later in the year was more equivocal. There was certainly a second period of nest detection around October consistent with a smaller peak in copulations and increased territoriality around the same time: 30% of study pairs exhibited a *c.* 6-month cycle in copulatory behaviour, occurring in both March–April and September–October. This was also consistent with patterns of moult, which appeared to follow the predicted peaks and troughs in breeding activity. Available data indicate that individuals undergo a partial (body) moult between June and October, which is followed by a more complete (wing and body) moult in December and January (Currie *et al.* 2002b). However, there was also good evidence that some pairs initiated breeding attempts throughout the year in response to both known and presumed failed breeding attempts, which would result in a protracted breeding season: three nests detected in November and December were on territories which had failed earlier in the year.

In long-lived socially monogamous bird species, copulations may have a function other than fertilization (Birkhead and Møller 1992). Some degree of caution should therefore be exercised in interpreting the functionality of copulation calls, especially as in one instance a copulation call was observed to occur when both members of the pair were bill-to-bill during allo-preening, post-duetting. However, in general, the timing of copulation calls, both spontaneous and those detected during playback, were consistent with the subsequent detection of nests and fledglings and therefore provided a reliable indicator of the reproductive status of pairs.

Breeding success

The limited data from this study suggest that breeding success was low: only two of eight nests found were successful, and only 11 fledglings were detected over 2 years, despite their relatively conspicuous calls and behavioural evidence of pairs breeding. It is important to note that breeding success of study pairs also appeared to be highly variable. For example, four breeding attempts were documented on one territory May–December 1999, all of which failed: only one fledgling was detected on this territory during the study. This contrasted markedly with another territory on which three fledglings were produced between July 1999 and November 2000 from apparently consecutive breeding attempts.

Prior to human colonization of the Seychelles, the scops-owl presumably had few natural nest-predators. Weather and food availability, and their respective

impacts on supplementary feeding and brooding efficiency, were probably important factors influencing breeding success. The impact of the subsequent introduction of alien species that are potential nest- and fledgling-predators e.g. rats *Rattus rattus* and *R. norvegicus*, domestic cats *Felix catus* and Barn Owl *Tyto alba affinis*, and potential nest-site competitors e.g. Common Mynah *Acridotheres tristis* on scops-owl breeding success is unknown. However, alien species are documented, or suspected, to have a significant deleterious effect on the breeding success of other Seychelles endemic landbirds (e.g. Rocamora and Françoise 2000, Watson 1991a). Anecdotal observations suggest that introduced predators/nest-site competitors pose a potential, but as yet unquantified, threat to scops-owls breeding success. Barn Owls, which are documented as predating Little Owls *Athena noctua* (about the same size as the Seychelles Scops-owl) and are therefore potentially predators of fledglings and adults, were detected on most study territories. The density of Black Rats and mynahs, although not quantified, also appeared to be high. Evidence suggests strongly that at least two nests failed due to depredation by Black Rat. Rats were also observed near a nest-cavity during filming (at only two nests), while rat droppings and food storage were found in cavities previously used by nesting owls. Several confirmed scops-owl nest-cavities had also previously been occupied by mynahs (see below).

Conservation implications

Monitoring

Accurately measuring breeding success is an important component in monitoring and management of threatened species. The mountainous terrain and the obvious difficulties this entails for monitoring Seychelles Scops-owl are further compounded by difficulties in finding nests. Experience from this study suggests that even with intensive fieldwork insufficient nests will be found to provide a meaningful long-term measure of breeding success in natural cavities: only eight nests were discovered between April 1999 and May 2001, and of the 11 fledglings observed only one was produced from a located nest. Radio-telemetry proved ineffective in monitoring birds due to individuals being able to remove tags glued to their backs (harnesses were not used due to difficulties in recapturing individuals to remove them and the potential risk to a Critically Endangered species), the limited tag life, and the mountainous terrain which interfered with the radio signal. Similarly, thick foliage meant that night-vision equipment proved ineffective for monitoring birds. Nests were best located just prior to and during incubation, when the female usually begged from and in the vicinity of the nest-cavity. Post-hatching, begging by the female declined, and the single chick could not usually be heard except in very close proximity to the nest (1–2 m) and was therefore likely to go undetected from the ground due to the height of nest cavities (7–25 m).

In light of the difficulties in finding nests in natural cavities, nest boxes were installed on eight territories. Six nest boxes, three small and three large of a design similar to that used by other *Otus* species in temperate climates (dimensions of boxes $l \times b \times h$ (cm): small box, $20 \times 20 \times 35$ [front]/ 40 [back]; large box, $25 \times 25 \times 40$ [front]/ 45 [back]), were erected on the centre of each territory in late 1999 and early 2000. As of July 2001, there was no evidence that any had been

used by scops-owls, although c. 60–70% were or had been occupied by the introduced Common Mynah. Furthermore, the wooden boxes, although treated, rotted very quickly in the high-altitude mist forest, and all will be useless in less than 2 years.

The other alternative approach to measuring breeding success is to monitor territories for fledglings, which can be detected by their conspicuous “whsst” call. However, evidence in this study of a protracted breeding season with some pairs breeding twice in a 12 month period, and fledglings being detected in most months of the year, would mean that single and/or infrequent visits to territories, currently employed during monitoring (Rocamora 1997), are likely to significantly underestimate, and therefore give a misleading measure of, breeding success. Systematic visits to territories every 3–4 months may be effective in detecting successful breeding attempts (i.e. the presence of fledglings), although unsuccessful nesting attempts would go undetected. In light of these difficulties, monitoring of the scops-owl might be best directed at long-term data collection on territory occupancy, and adult survivorship via the identification of colour-ringed individuals.

Forestry practices

Anecdotal observations during the study suggested that breeding Seychelles Scops-owls were sensitive to persistent localized disturbance: one nest failure occurred simultaneously with localized forestry activity and several pairs moved more than 300 m in response to the same disturbance. These concerns should be considered when proposing developments and activities in scops-owl “sensitive” areas.

The scops-owl’s current range is dominated by mature secondary forest, primarily Cinnamon *Cinnamomum verum* and Albizia *Paraserianthes falcataria*, with a larger proportion of native vegetation at higher altitudes. Nests were only found in mature specimens of two less-common tree species, the endemic Bwa Rouz and the introduced Sangdragon: both are hardwood species and appear to contain more numerous and drier cavities than other tree species. Cinnamon is probably unsuitable as a nest tree due to its typical small trunk diameter, in many cases a consequence of past coppicing activities. The importance of Albizia and plantation tree species (e.g. Mahogany *Swietenia* spp. and Santol *Sandoricum koetjape*) for scops-owls are unknown, although White-tailed Tropicbirds *Phaeton lepturus*, which are tree-cavity nesters on Mahé, used cavities in Albizia, as well as those in Bwa Rouz and Sangdragon. In addition to minimizing forestry activities in owl-sensitive areas, forestry practices should also include prescriptions for maintaining both Bwa Rouz and Sangdragon (dead and alive). Caution should perhaps also be exercised in the proposed control of Albizia, an introduced and highly invasive tree species, in scops-owl sensitive areas until its importance to the owl requirements is known.

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