

CONSERVATION OF WESTERN INDIAN OCEAN FRUIT BATS

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ABSTRACT.- The fruit bats of the western Indian Ocean islands are important components of these island ecosystems. Since fruit bats play key roles in the maintenance of tropical ecosystems as pollinators and seed dispersers, their continued survival may be of crucial significance for the maintenance of island forests. In turn the forests are important resources for the people of the region and protect vital watersheds. Continued survival of the western Indian Ocean fruit bats may thus be imperative for the conservation of the region's biodiversity. Many island endemics are susceptible to human-induced environmental degradation. In addition, most of the western Indian Ocean islands are affected by cyclones. These factors have led to the extinction of one species and five of the remaining 11 are threatened. Various strategies are being used to aid their conservation including captive breeding, education programmes and protection of wild populations.

KEY-WORDS.- Pteropodidae, Indian Ocean, Conservation, Distribution

RESUME.- Les Chauve-souris fruticoles des îles de l'Océan Indien sont des composants importants des écosystèmes de ces îles. Dans la mesure où les Chauve-souris fruticoles jouent des rôles clés dans le maintien des écosystèmes tropicaux en tant que polinisateurs et disperseurs de semis, leur conservation et survie peuvent être d'une signification cruciale pour le maintien des forêts insulaires. Par ailleurs, les forêts représentent des ressources importantes pour les personnes de la région et protègent également les ressources en eau. L'assurance de survie pour les Chauve-souris fruticoles de l'Océan Indien apparaît ainsi comme impérative pour la conservation de la biodiversité de la région. Plusieurs endémiques insulaires subissent la pression de la dégradation humaine sur l'environnement. De plus, la plupart des îles de l'Océan Indien sont perturbées par des cyclones. Ces facteurs ont conduit à l'extinction d'une espèce, et cinq autres sur les 11 restantes sont menacées. Diverses stratégies sont utilisées pour aider leur conservation y compris la reproduction en captivité, des programmes d'éducation et protection des populations sauvages.

MOTS-CLES.- Pteropodidae, Océan Indien, Conservation, Distribution

INTRODUCTION

Three genera of fruit bats (11 extant taxa) occur in the Western Indian Ocean: *Pteropus*, *Rousettus* and *Eidolon* (Table I). The islands of the Western Indian Ocean (WIO) represent a « meeting point » for these bats. They are the western limit for distribution of members of the genus *Pteropus*, which does not extend further than Mafia, just off the coast of Tanzania; the eastern limit for distribution of members of the

genus *Eidolon*, which is not found beyond Madagascar and offshore islets; and central to the range of *Rousettus* (Fig.1). Several small islands and Madagascar have or had communities of three fruit bats (Table II).

TABLE I. FRUIT BATS OF THE WESTERN INDIAN OCEAN

<i>Eidolon dupreanum</i>	not threatened
<i>Pteropus livingstonii</i>	endangered
<i>Pteropus niger</i>	vulnerable
<i>Pteropus rodricensis</i>	endangered
<i>Pteropus rufus</i>	not threatened
<i>Pteropus seychellensis aldabrensis</i>	vulnerable
<i>Pteropus seychellensis comorensis</i>	not threatened
<i>Pteropus seychellensis seychellensis</i>	not threatened
<i>Pteropus subniger</i>	extinct
<i>Pteropus voeltzkowi</i>	endangered
<i>Rousettus madagascariensis</i>	not threatened
<i>Rousettus obliviosus</i>	not threatened

These fruit bats range in size from 40-800 g and occur from sea level to 1500 m. In common with most groups of bats, their ecology is poorly known. *Rousettus* is a cave-roosting genus (although *R. angolensis* has also been reported roosting among dead palm fronds (BERGMANS, 1979). No roosts are documented for either *R. obliviosus* or *R. madagascariensis*, but presumably they rely on caves. *Eidolon* is predominantly a tree-roosting genus, but *E. dupreanum* has been reported to roost in cave entrances as well as in trees in the Ankarana region of Madagascar (WILSON, 1987). *Pteropus* is exclusively a tree-roosting genus.

Fruit bats feed almost entirely on plants, taking fruit (sometimes including seeds), flowers, nectar and leaves. The diet of *Pteropus* species of the WIO is incompletely known, but existing information suggests a wide variety of fruit, flowers and leaves are eaten (CARROLL, 1981; RACEY & NICOLL, 1984; CARROLL & THORPE, 1990). The diet of *Rousettus* and *Eidolon* is less well known. Capture of *R. obliviosus*, *P. s. comorensis* and *P. livingstonii* at the same kapok and fig feeding sites on Anjouan suggest that feeding niches at least overlap (YOUNG *et al.*, 1993). There is also some evidence from height of capture, for partial vertical separation of these species (YOUNG *et al.*, 1993).

The fruit bats of the WIO show very high levels of endemism, with several species restricted to single islands (Table III). This is particularly true of the genus *Pteropus*, which can be considered an island taxon: 55 of the 57 species (96.5%) have all or some of their distribution on islands. Endemism within this genus is high with 35 of the 57 species (61.4%), confined to single islands or small island groups (MICKLEBURGH *et al.*, 1993).

TABLE II. HISTORICAL FRUIT BAT COMMUNITIES IN THE WESTERN INDIAN OCEAN

Mauritius	<i>Pteropus niger</i>
	<i>Pteropus rodricensis</i> *
	<i>Pteropus subniger</i> **
Réunion	<i>Pteropus niger</i> *
	<i>Pteropus subniger</i> **
Comores	<i>Pteropus livingstonii</i>
	<i>Pteropus seychellensis comorensis</i>
	<i>Rousettus obliviosus</i>
Madagascar	<i>Eidolon dupreanum</i>
	<i>Pteropus rufus</i>
	<i>Rousettus madagascariensis</i>

* no longer exists on this island, ** extinct

CONSERVATION PROBLEMS

Many island endemics are highly susceptible to human-induced environmental degradation, particularly through the removal of feeding and roosting sites by forest clearance for agriculture (ROBERTSON, 1992). Persecution and commercial hunting also affect some fruit bat populations. Additionally, many of the WIO islands are subjected to regular tropical storms. If habitat is limited or of poor quality, cyclones can have a devastating effect on bat populations by removing natural vegetation and blowing unprotected bats in areas of poor cover out to sea (CARROLL, 1984). A combination of these factors has led to the extinction of one species, and three others are now endangered. Thus 50% of the WIO fruit bats are of conservation concern (Table I).

CONSERVATION STRATEGIES

Various strategies, including legislation, habitat protection, conservation education and captive breeding, are being used to assist the conservation of threatened WIO fruit bats (MICKLEBURGH & CARROLL, 1994).

TABLE III. DISTRIBUTION OF WESTERN INDIAN OCEAN FRUIT BATS

<i>Eidolon dupreanum</i>	Madagascar and offshore islets
<i>Pteropus livingstonii</i>	Anjouan and Moheli (Comores)
<i>Pteropus niger</i>	Mauritius (extinct in Reunion)
<i>Pteropus rodricensis</i>	Rodrigues (extinct in Mauritius)
<i>Pteropus rufus</i>	Madagascar
<i>Pteropus s. aldabrensis</i>	Aldabra
<i>Pteropus s. comorensis</i>	Anjouan, Grande Comore, Moheli (Comores), Mayotte (French Dept.), Mafia (Tanzania)
<i>Pteropus s. seychellensis</i>	Cousin, Curieuse, La Digue, Felicite, Mahé, Marianne, Praslin (Seychelles)
<i>Pteropus subniger</i>	(extinct in Mauritius and Reunion)
<i>Pteropus voeltzkowi</i>	Pemba (Tanzania)
<i>Rousettus madagascariensis</i>	Madagascar
<i>Rousettus obliviosus</i>	Anjouan, Grande Comore, Moheli (Comores)

Legislation and habitat protection

All *Pteropus* bats are listed on CITES Appendix II, and *P. rodricensis* and *P. niger* are covered by the East African Region Protocol, though this is not yet in force. The World Heritage Convention protects *P. s. aldabrensis* on Aldabra Atoll (MICKLEBURGH *et al.*, 1993). Local legislation is in place or being developed for the protection of *P. livingstonii*, *P. niger* and *P. rodricensis*. Habitat restoration is underway for *P. rodricensis* and *P. niger* and roost protection exists for *P. rodricensis* and is being formulated for *P. livingstonii*. Although not a protected species, roosts of *P. niger* are protected within the Black River Gorges National Park Mauritius and roosts of *P. rufus* occur in several protected areas in Madagascar.

Conservation education

Education is also an important component of a comprehensive conservation strategy. Posters depicting fruit bats and highlighting their status and importance to forest ecosystems have been distributed in Pemba (*P. voeltzkowi*) and the Comores (*P. livingstonii*). These posters are part of local education programmes aimed at raising awareness about fruit bats on these islands, and are complemented by other education material such as slide packs, stickers, badges, etc. (TREWHELLA & REASON, 1992; ACTION COMORES, 1993).

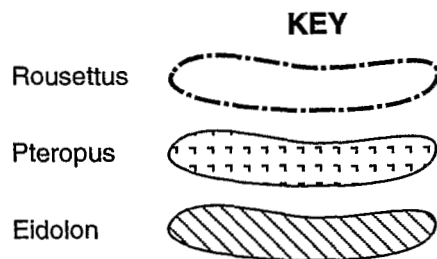
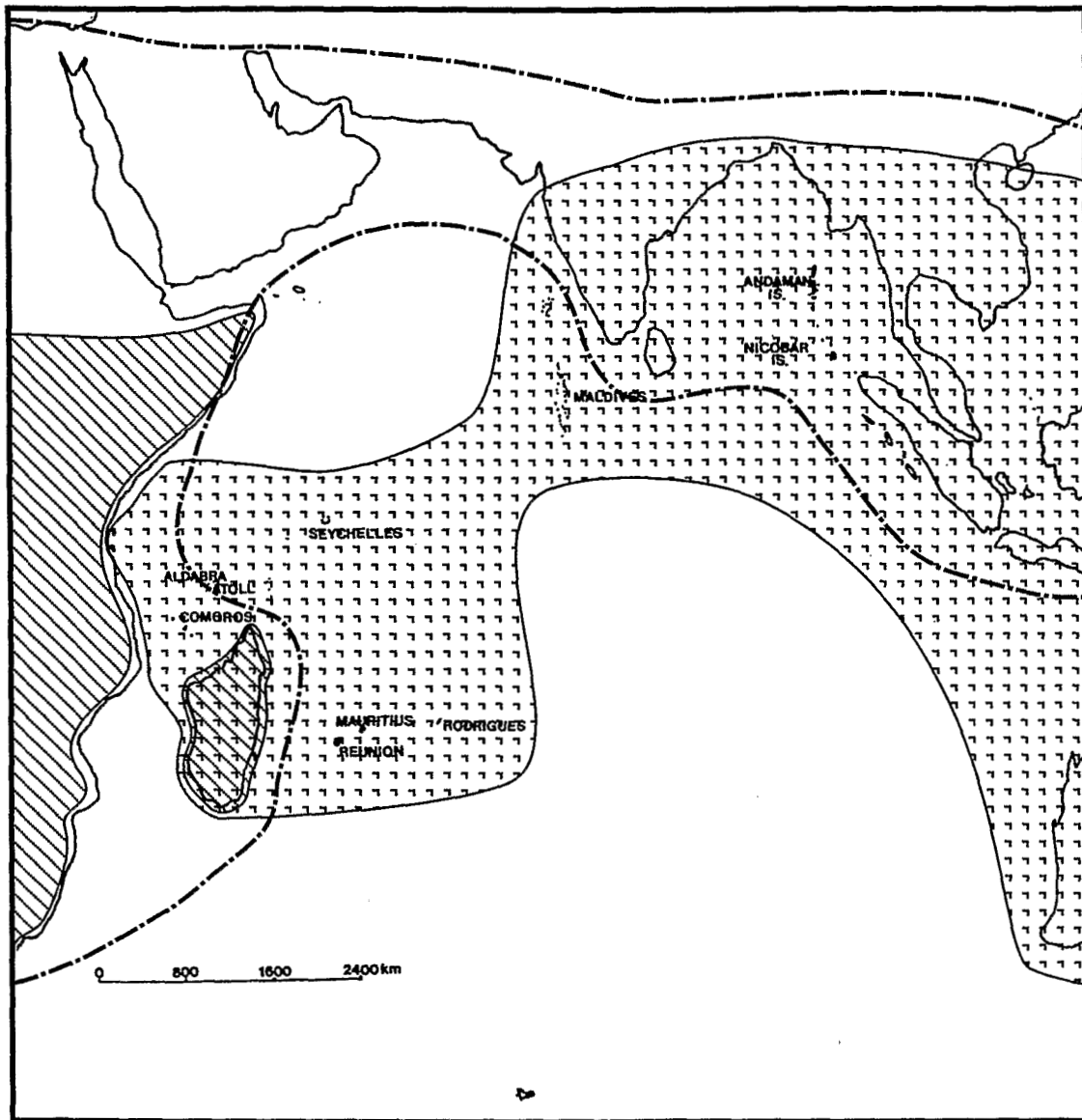


Fig. 1. Distribution of the three genera of Western Indian Ocean fruit bats (*Rousettus*, *Pteropus*, *Eidolon*).

Captive breeding

Three captive breeding programmes (CBP) have been established for WIO fruit bats. One programme (*P. rodricensis*) involves both *in-situ* and *ex-situ* breeding, while the other two (*P. livingstonii* and *P. voeltzkowi*) are currently *ex-situ*.

***Pteropus rodricensis*:** The CBP for this species started in 1976, with the establishment of two founder colonies; one founded with 3.7 (3 males and 7 females) at the Jersey Wildlife Preservation Trust (JWPT), the other (3.5) at Black River (BR) in Mauritius, later supplemented with 2.7 after 4 animals died. All bats remain the property of the Government of Mauritius. The bats bred very successfully and further colonies were established using one sex from JWPT and the other from BR. In early 1995, the International Studbook listed 542 bats in 18 institutions in USA, British Isles, Europe, Africa and Mauritius. The population is being managed over the long term for retention of 90% genetic variability (CARROLL & MACE, 1988).

***Pteropus livingstonii*:** The CBP for Livingstone's fruit bat was started in 1992 at JWPT with the import of 5.1 bats from the Comores (TREWHELLA *et al.*, 1995). These were supplemented with a further 5.1 in 1993 (YOUNG *et al.*, 1993) and with 0.5 in 1995. All bats remain the property of the Government of the Comores. Three female infants have been produced, two surviving. Future plans will follow the successful strategy developed with the Rodrigues fruit bat. Two colonies will be established in separate locations and new colonies will be founded using captive-bred stock from each founder colony.

***Pteropus voeltzkowi*:** This programme was initiated in 1994. A total of 18 bats was acquired of which 6.6 were imported to Phoenix Zoo, USA. Unfortunately only 4.1 of these survive. A further capture attempt is scheduled for September 1995 (J. SEYJAGET, pers. comm.).

The *ex-situ* CBPs also provide important opportunities for research. Both the *P. rodricensis* and *P. livingstonii* at JWPT are the focus of research programmes, involving studies of captive management, behaviour, and reproduction (CARROLL, 1979; WEST, 1986; YOUNG & CARROLL, 1989; HAYES *et al.*, in press; HERRON, 1993; COURTS, in prep.). The captive bats also contribute to studies of genetics and morphology.

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